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PROOF TEST CRITERIA FOR THIN-WALLED 2219 ALUMINUM PRESSURE VESSELS

VOLUME II - CRACK OPENING DISPLACEMENT AND STRESS-STRAIN DATA

By
R. W. Finger

THE BOEING AEROSPACE COMPANY

Prepared For
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA Lewis Research Center
Contract NAS3-18906
Gordon T. Smith, Project Manager

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NASA Lewis Research Center
Cleveland, Ohio 44135

16 Abstract

This experimental program was undertaken to investigate the crack growth behavior of deep surface flaws in 2219 aluminum. The program included tests of uniaxially loaded surface flaw and center crack panels at temperatures ranging from 20K (-423°F) to ambient. The tests were conducted on both the base metal and as-welded weld metal material. The program was designed to provide data on the mechanisms of failure by ligament penetration, and the residual cyclic life, after proof-testing, of a vessel which has been subjected to incipient penetration by the proof test. The results were compared and analyzed with previously developed data to develop guidelines for the proof-testing of thin walled 2219 pressure vessels.

17 Key Words (Suggested by Author(s))		18 Distribution Statement
Surface Flow	Cyclic Flaw Growth	Unclassified, Unlimited
2219 Aluminum	Pressure Vessels	
Fracture Control	Stress Intensity	
Proof Testing	Crack Opening Displacement	

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FORWORD

This report contains the crack opening displacement records developed during an investigation of the crack growth characteristics of both center crack and part through surface cracks and the extensometer and strain gage data developed during the mechanical property testing portion of the program. The work was performed by the Boeing Aerospace Company from July 1974 to September 1975 under NASA Contract NAS3-18906. The work was administered by Mr. Gordon T. Smith of the NASA-Lewis Research Center.

This program was conducted by the Research and Engineering Division of the Boeing Aerospace Company, Seattle, Washington, under the supervision of Mr. H. W. Klopfenstein, Structures Research and Development Manager. The Program Leader was Mr. J. N. Masters, Supervisor, Failure Mechanisms Group. The Technical Leader was R. W. Finger; A. A. Ottlyk and H. M. Olden provided testing engineering support, and G. Buehler produced the technical illustration and art work. This technical report is also released as Boeing Document D180-20100-2.

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INTRODUCTION

This report contains the crack opening displacement records obtained during the testing of both the center crack and surface flawed specimens and the extensometer and strain gage curves from the mechanical property characterization portion of the program. The remainding test data is summarized and discussed in CR-135036 (Reference 1).

The crack opening displacement records presented are reproductions of the actual traces. The specimen number is given on each plot so that the other detailed test information can be located in CR-135036. Peculiarities encountered during testing have been noted on the individual plots. Some general comments pertinent to all of the plots are presented below:

- The Electrical Deflection Indicator (EDI) was reset after each load cycle;
- The EDI gage was spring loaded against integrally machined knife edges for all of the center crack panels and all of the 6.35 mm and 9.53 mm (0.25 and 0.375 in) thick surface flaw specimen. Clip gage brackets were used for attaching the EDI to the remaining specimen;
- All of the center-crack panels were loaded directly to failure, therefore, all of the associated crack opening displacement records are for the fracture loading;
- The surface flawed specimens were subjected to a variety of different loadings which are denoted on the plots.

The crack opening displacement records were used to calculate the constant "c_o" in the following equation

$$\delta = c_o \frac{\sigma a}{\sqrt{Q}}$$

where δ = crack opening displacement
σ = gross area applied stress
a = flaw depth
Q = flaw shape parameter (presented in Figure 6 of NASA CR-135036

Only the initial linear portion of the crack opening displacement records was considered in making these calculations. This was done to avoid the region stable crack growth and to permit the initial crack dimension to be used. The calculated c_o values were compared to those presented in Appendix B of Reference 2. Reference 2 found that the calculated c_o value was dependent upon the ratio of flaw depth to specimen thickness (a/t) and the flaw shape (a/2c). Under the subject study three different flaw shapes were considered within a limit range of flaw depth to specimen thickness (a/t's). The calculated c_o values from this report were in good agreement with the Reference 2 values. Additionally, the "c_o" values have been compared to a theoretical solution of Kobayashi (3). The agreement between the experimental values obtained in both this study and Reference 2 with the theoretical solution is quite good especially for flaw depth to thickness ratios in excess of 0.40.

The slopes of the crack opening displacement record during load and unloading were compared to the initial and final flaw sizes. The linear portion of the loading curve and the initial linear portion of the unload curve were considered in these calculations. It was hoped that these linear portions of the curves being reflection of the compliance of the specimen at the flaw would be directly relatable to flaw size. The ratio of final to initial compliance was compared to the ratio of final to initial flaw depth. The data generally fell within an acceptable scatter band, however, there were a number of points which varied significantly from the general data trends. Specimen to specimen variation in flaw shape within target flaw shape range were not considered nor was the change in flaw shape as a result of the crack growing considered. The results of the brief investigation suggests that the comparison of the loading and unloading slopes will generally yield some insight into the extent of stable crack growth that has occurred. A further review of the crack opening displacement records may yield information which can be used to determine flaw sizes directly.

The load-extensometer and load-steam gage curves generated during the mechanical property characterization portion of the program are presented in Appendix III. The extensometer curves were used in the calculation of the yield strength. A 50.8 mm (2.0 inch) gage length was used for all of the extensometer tests.

The strain gage records have been identified as either axial strain gage or Poisson's strain gage. The axial strain gages were mounted on the specimen parallel to the loading direction and the Poisson's strain gages were oriented perpendicular to the loading direction. The strain gage results were used in the calculation of Poisson's Ratio.

References:

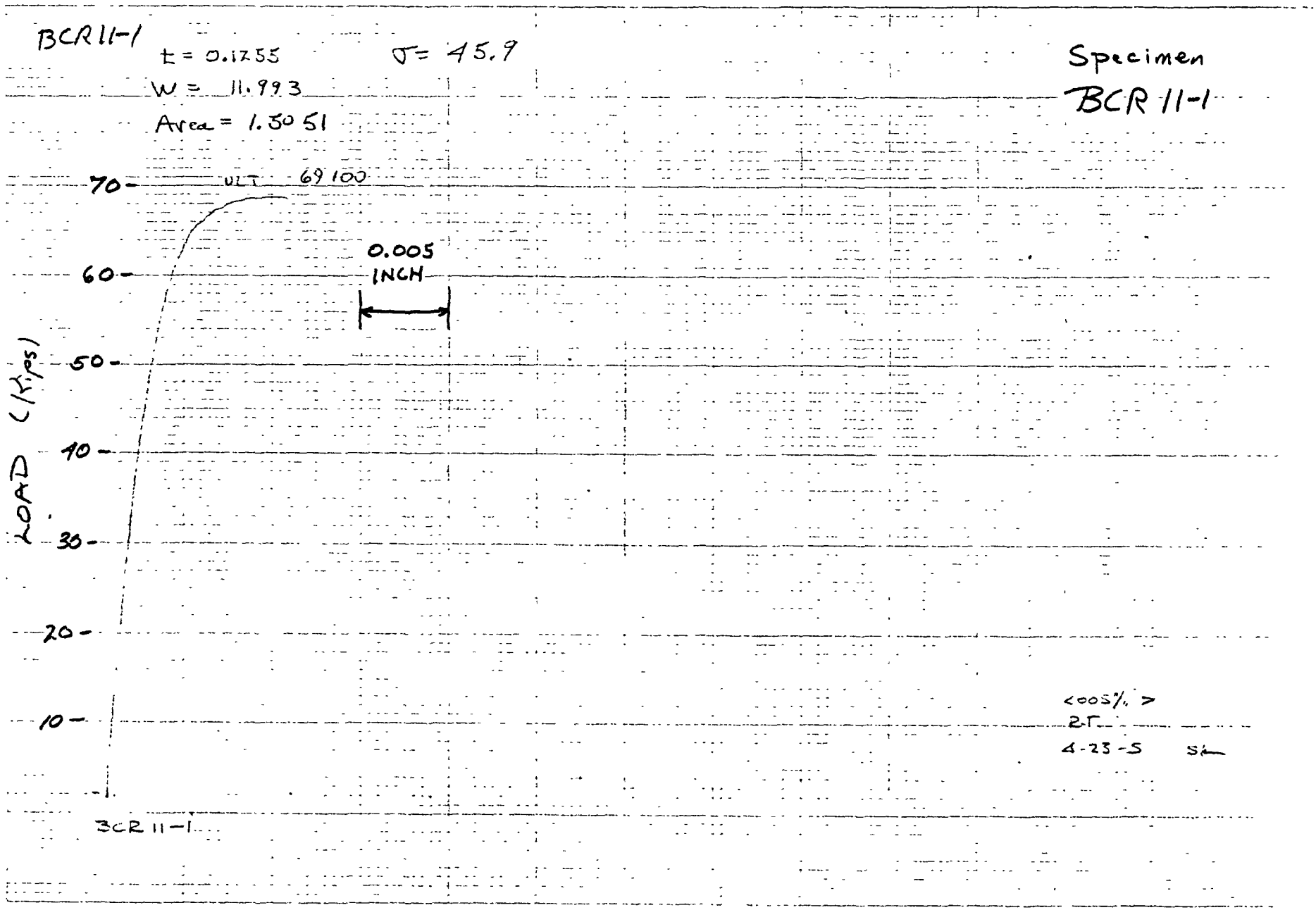
1. R. W. Finger, "Proof Test Criteria For Thin Walled 2219 Aluminum Pressure Vessels," Volume I NASA CR-135036, August 1976

2. J. N. Masters, W. D. Bixler, R. W. Finger, "Fracture Characteristics of Structural Aerospace Alloys Containing Deep Surface Flaws" NASA CR-134587, December 1973.

3. A. S. Kobayashi, "Crack Opening Displacement in A Surface Flawed Plate Subjected To Tension or Plate Bending". Boeing Document D180-19446-1, February 1976.

APPENDIX I - Center Crack Panel Crack Opening Displacement Records

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BCR 11-1
t = 0.1255
W = 11.993
Area = 1.5051
J = 45.9
Specimen
BCR 11-1
ULT 69100
0.005
INCH
70
60
50
40
30
20
10
LOAD (Kips)
<.005% >
RT
4-23-S
SA
BCR 11-1

BCR11-2

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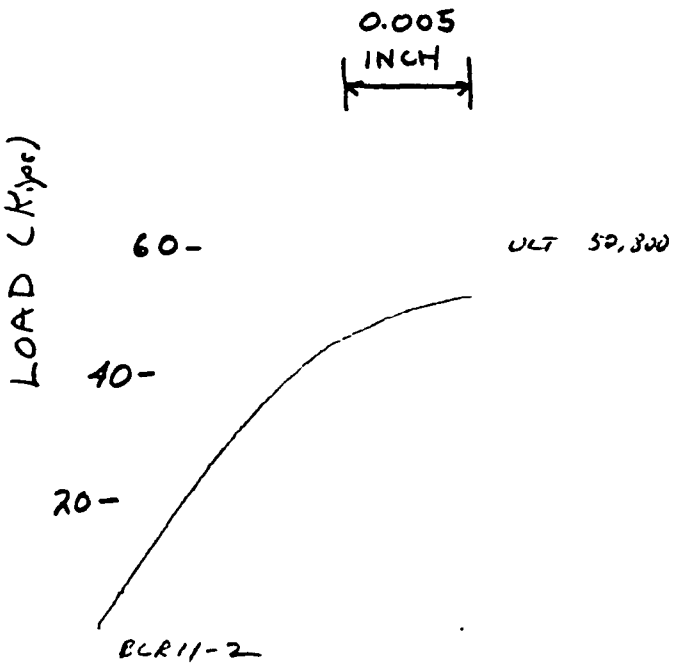
$\omega = 12.0$

$A_{nm} = 1.4829$

$\sigma = \frac{52.8}{1.4829} = 35.6$

Specimen

BCR 11-2



P.J.

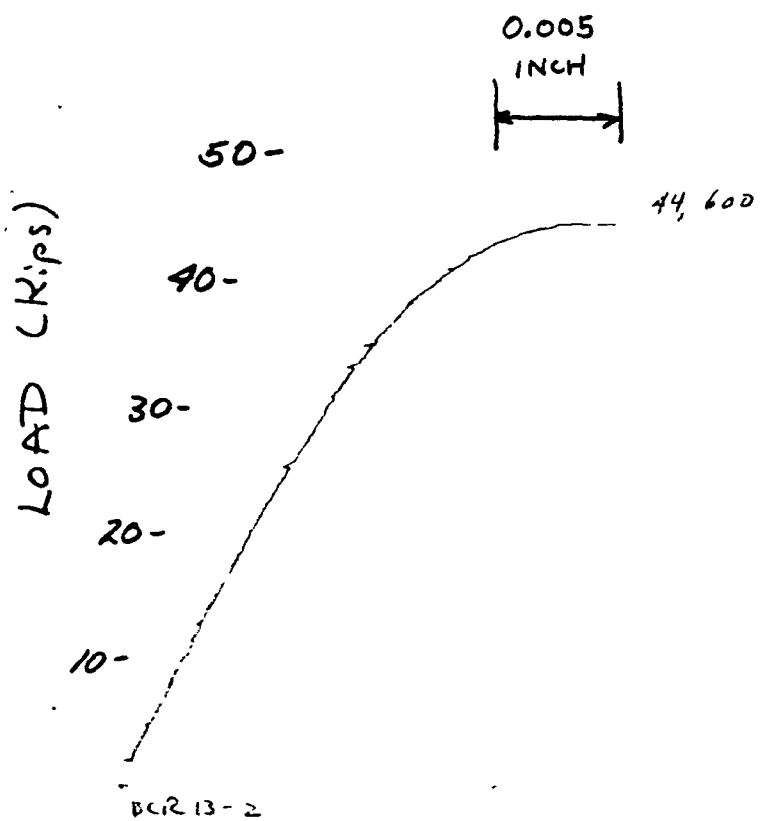
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$\chi = 7.5$

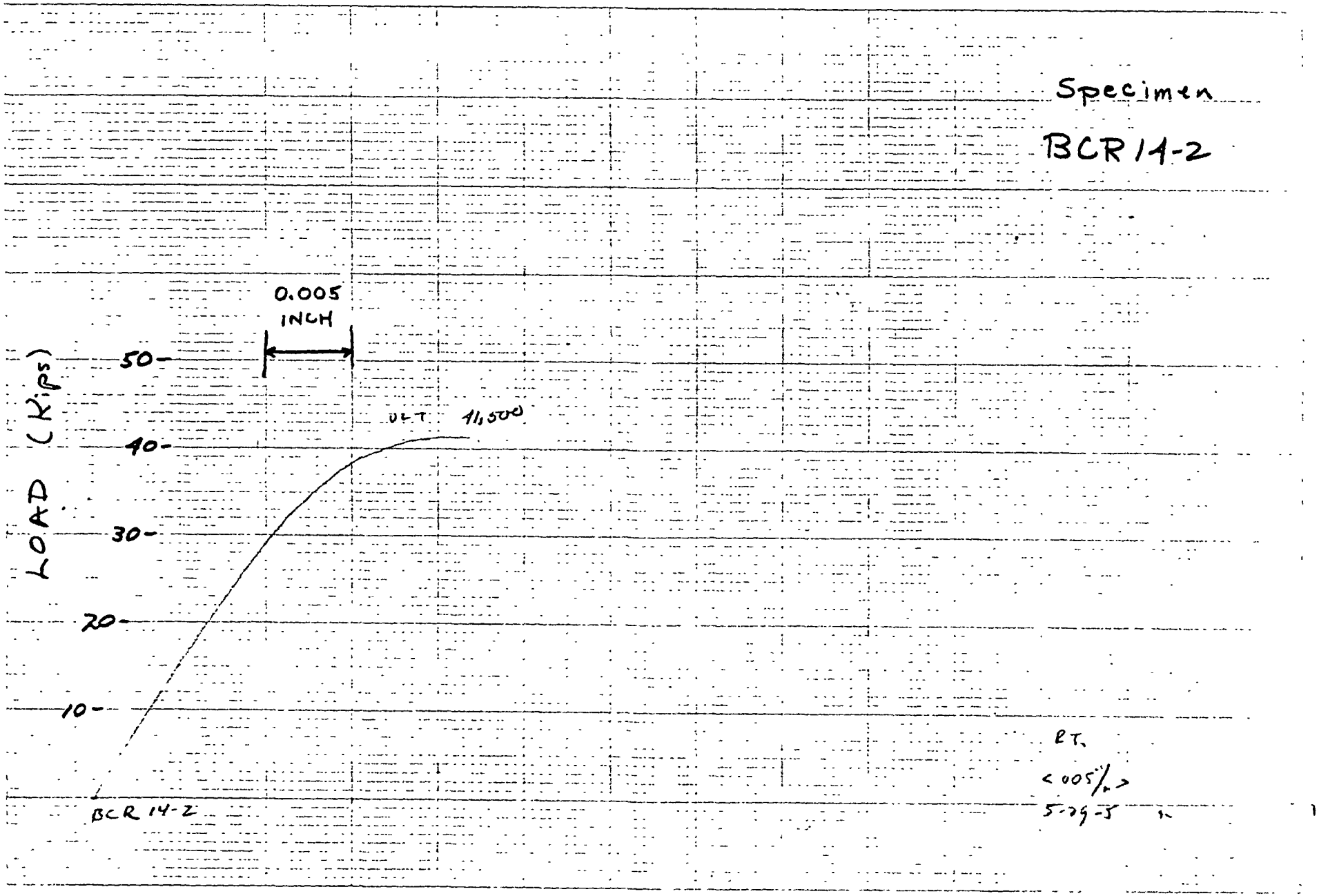
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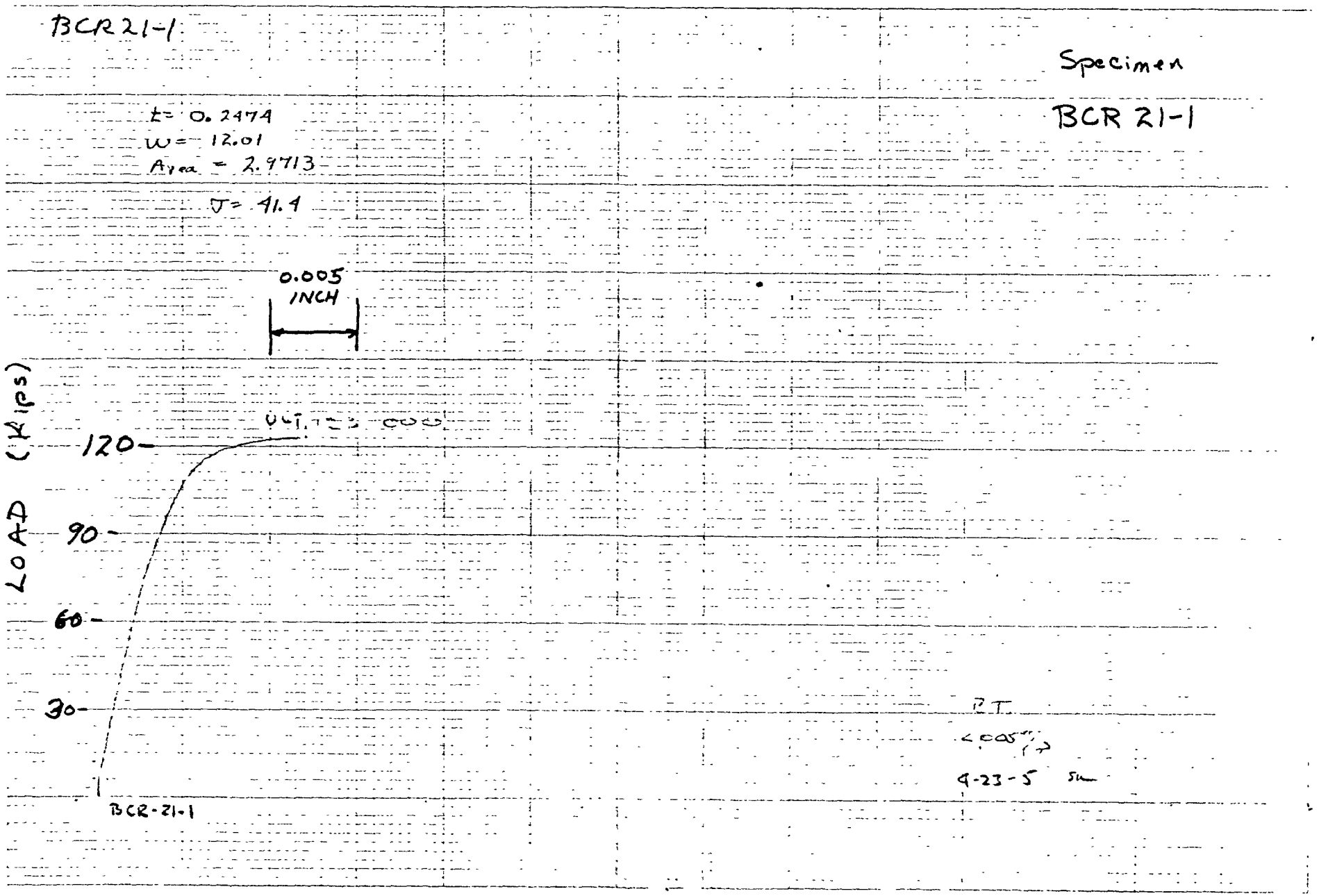
Specimen

BCR 13-2



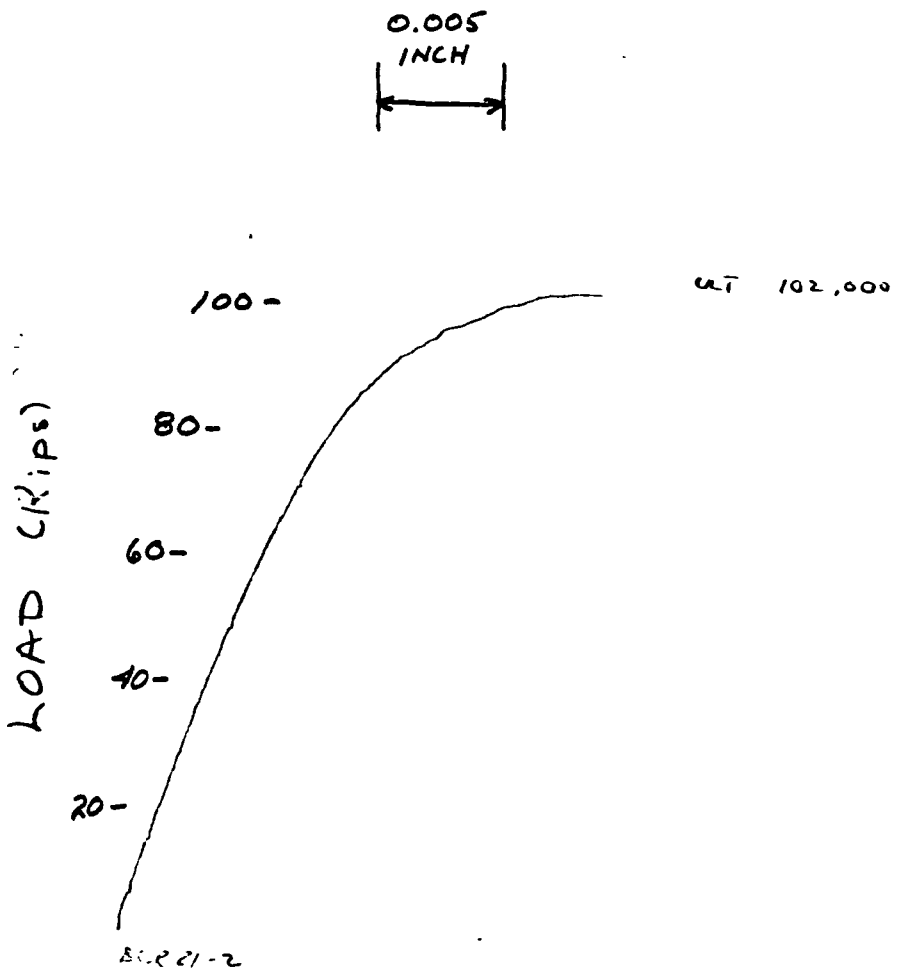
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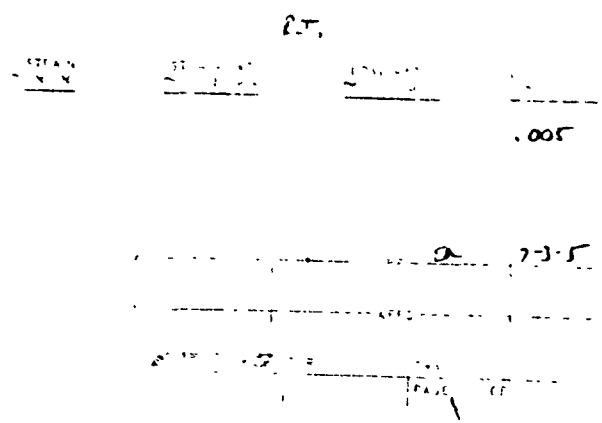

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30
20
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RT.
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5-29-5

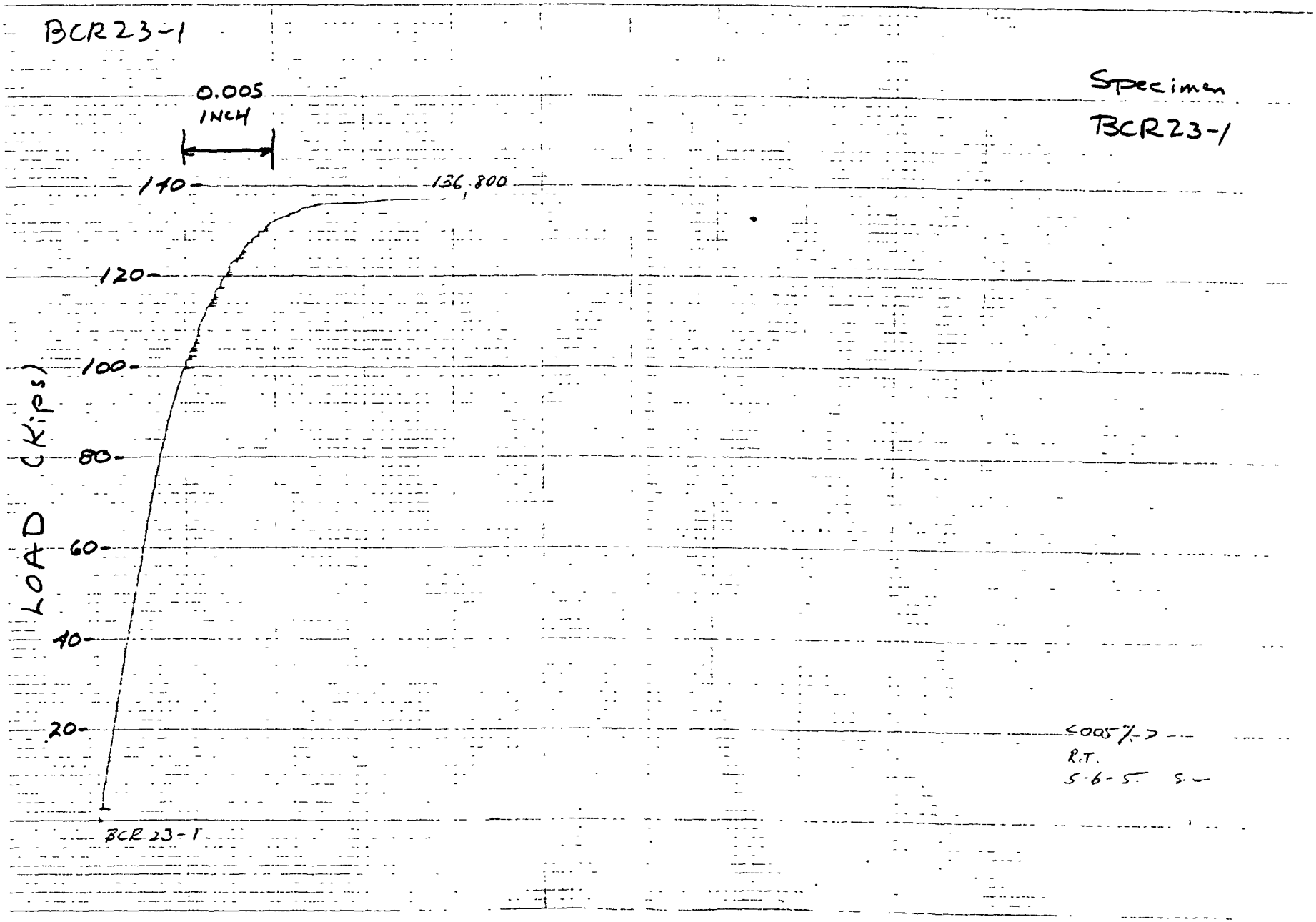

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30
BCR-21-1
RT

BCR 21-2

Specimen
BCR21-2



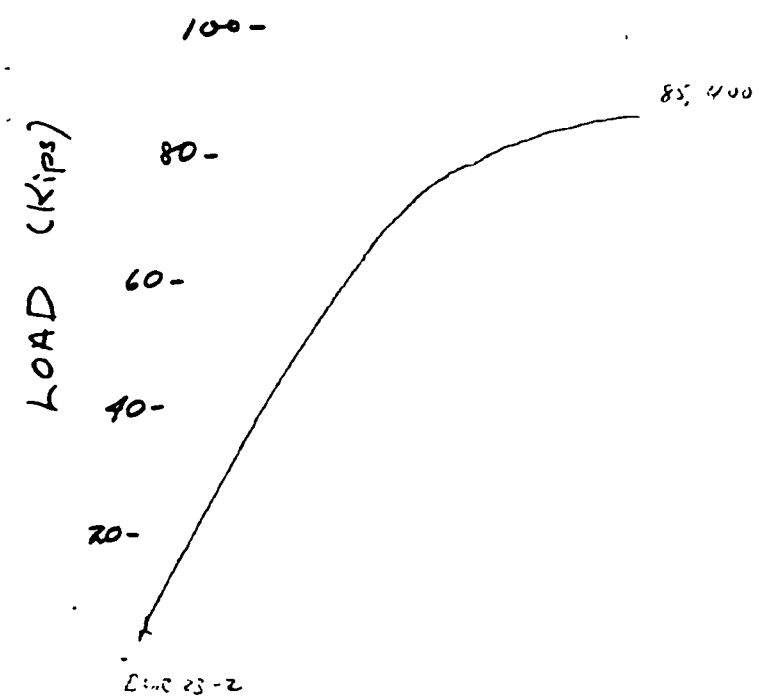


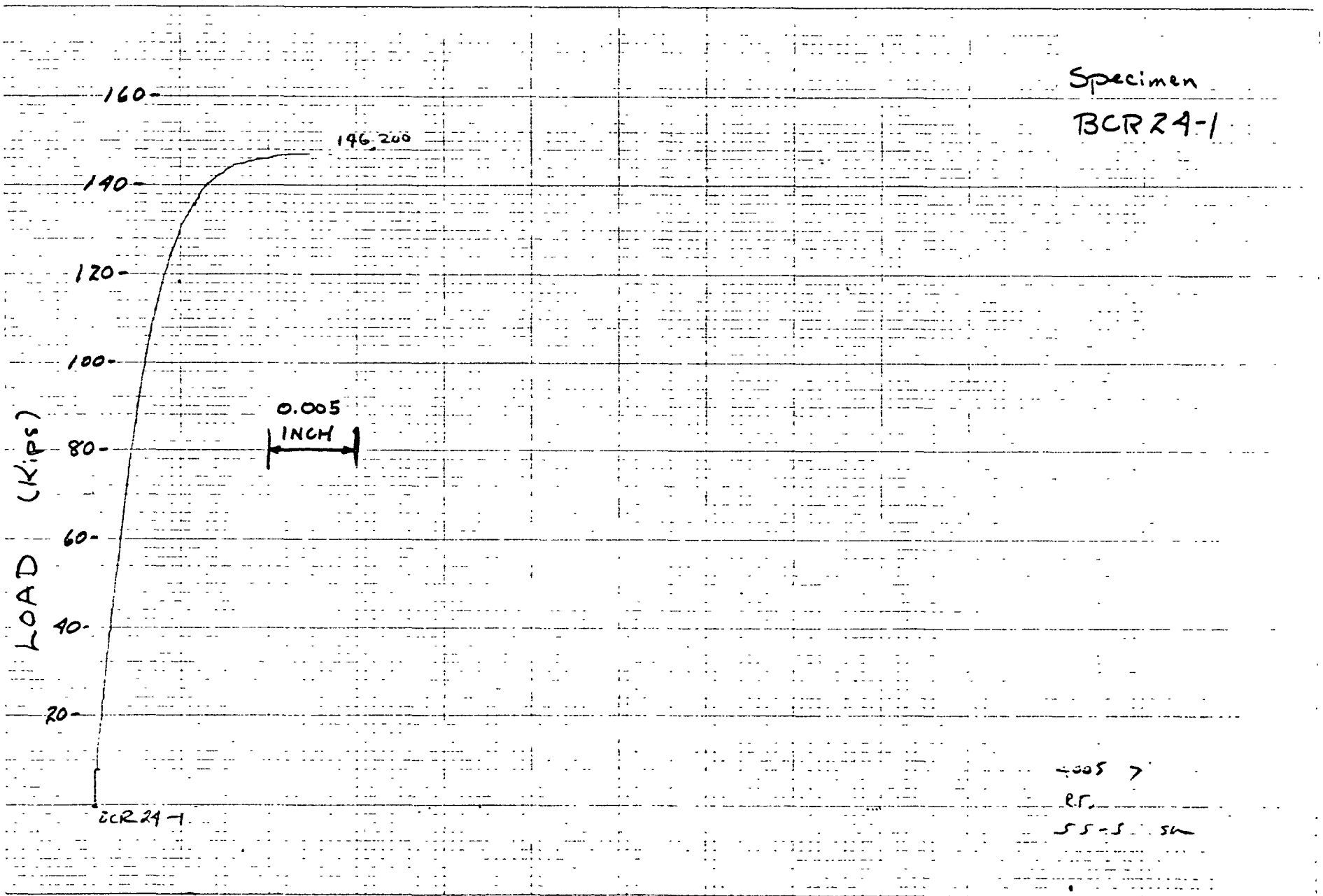

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5-6-5

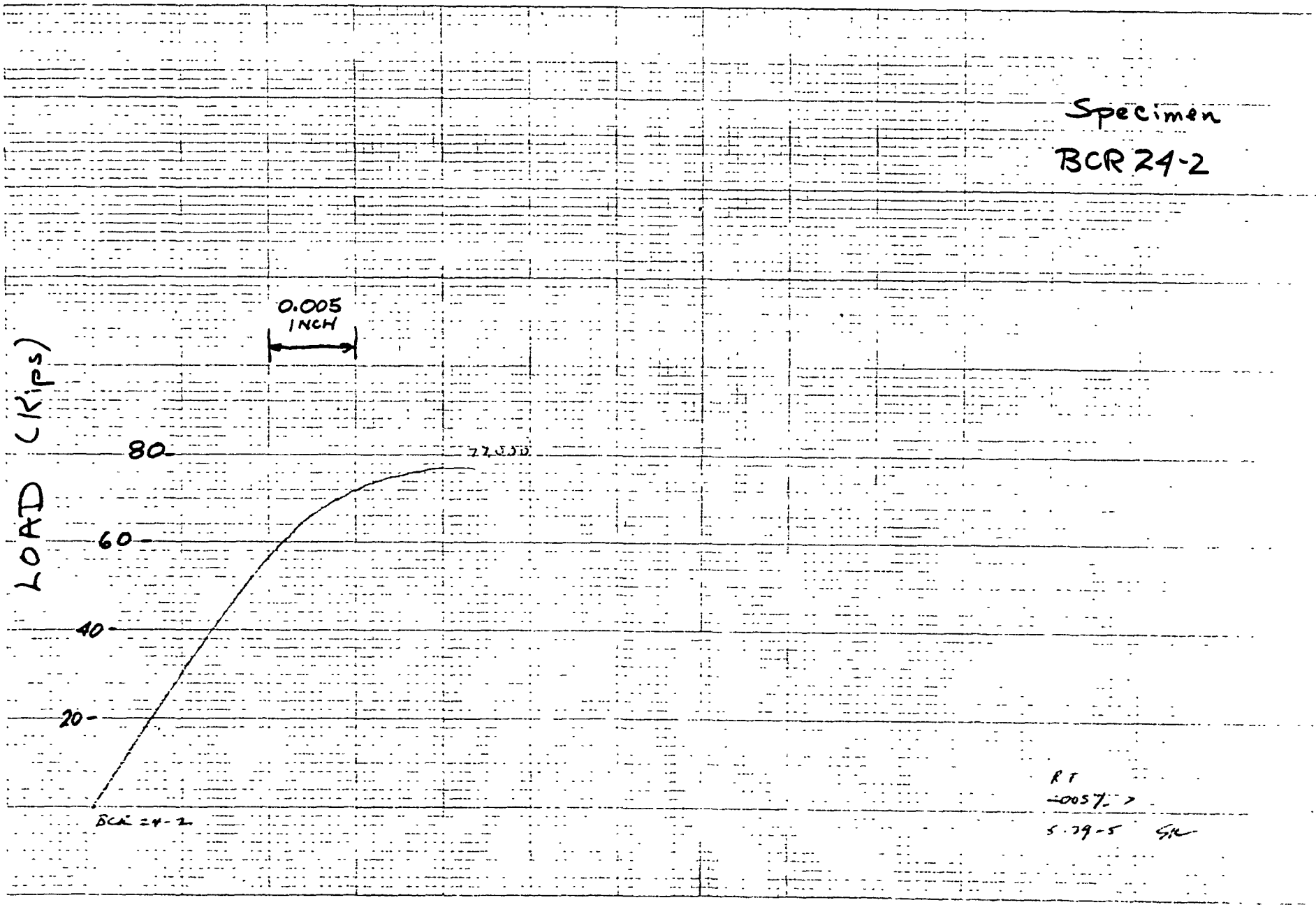
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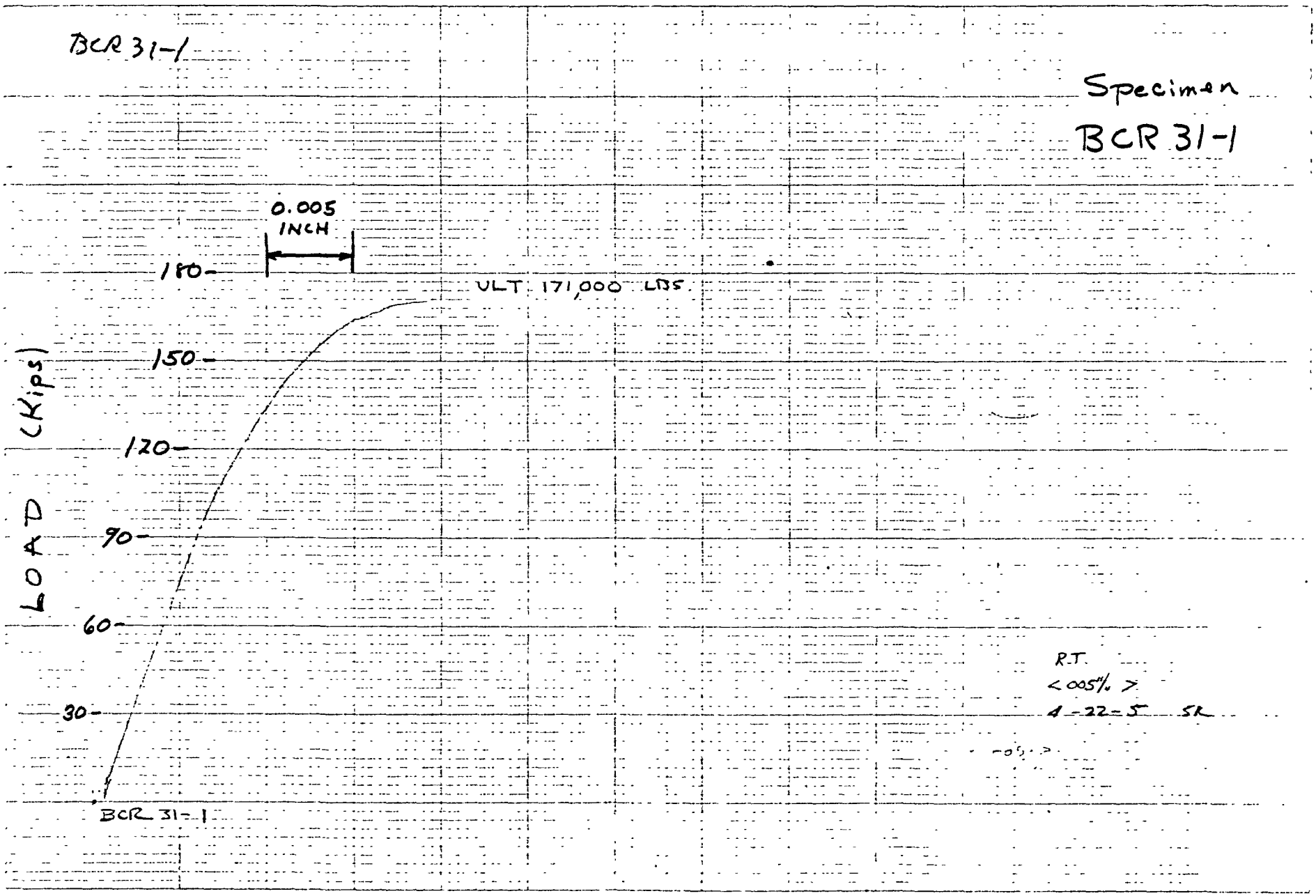
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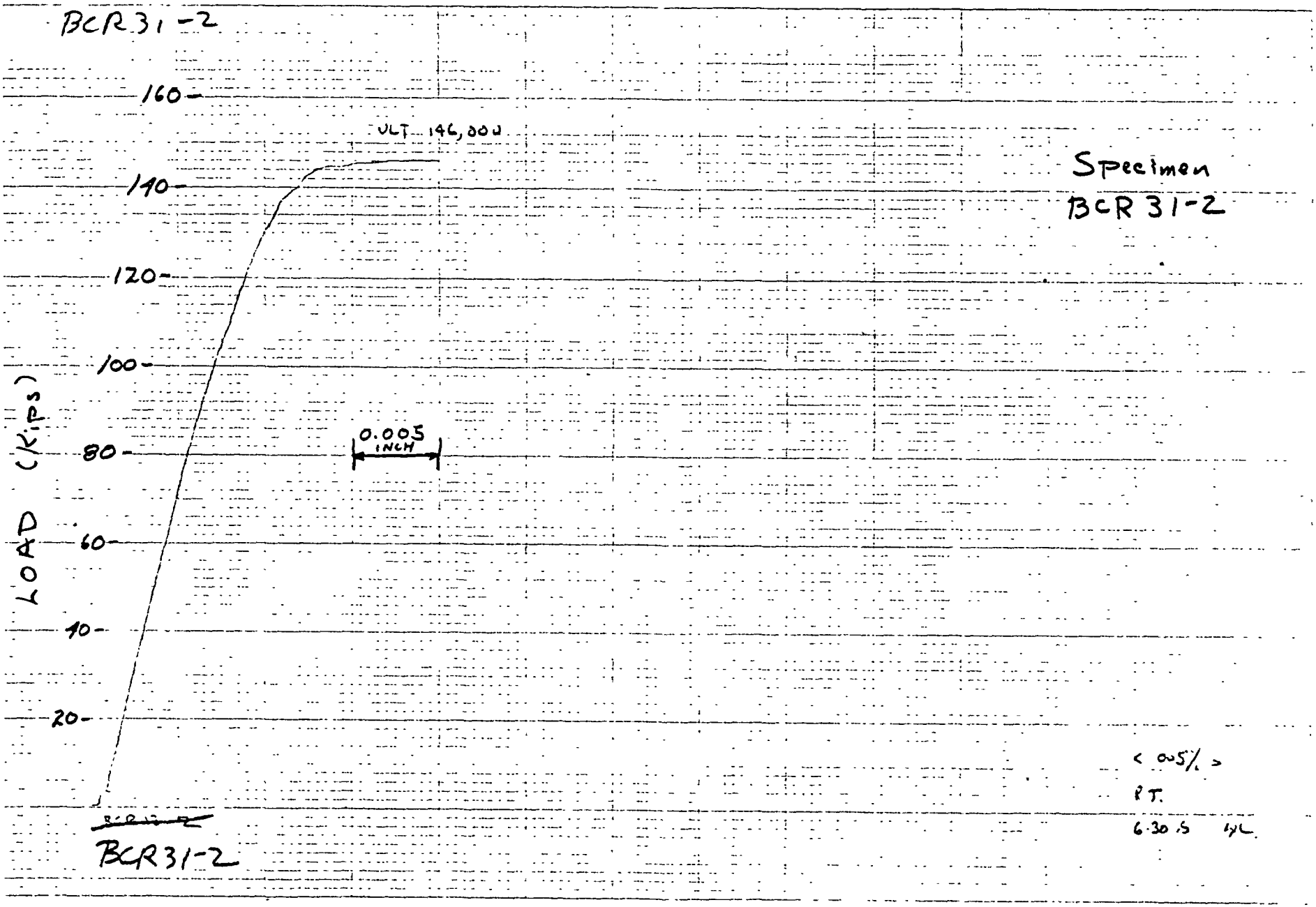
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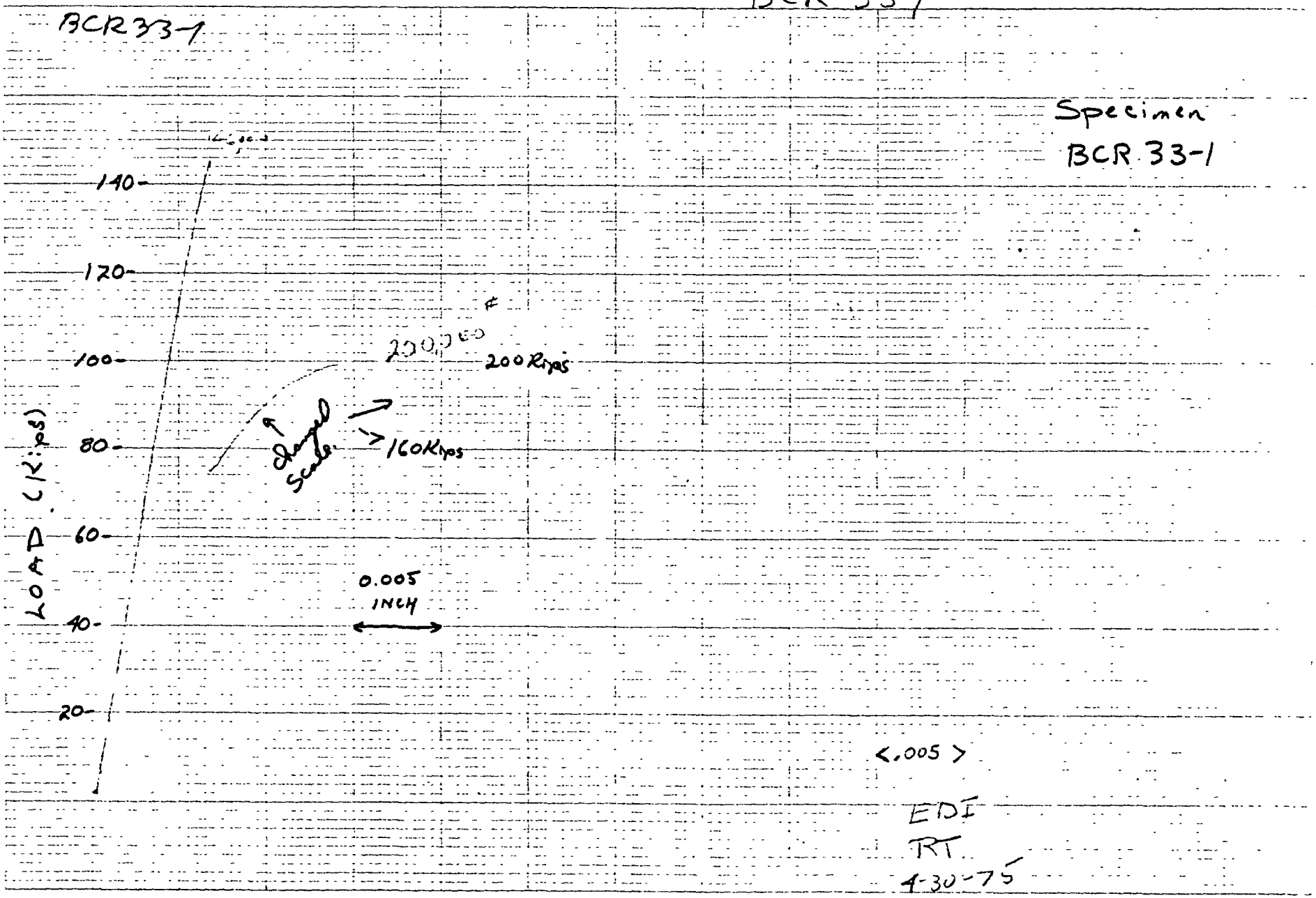

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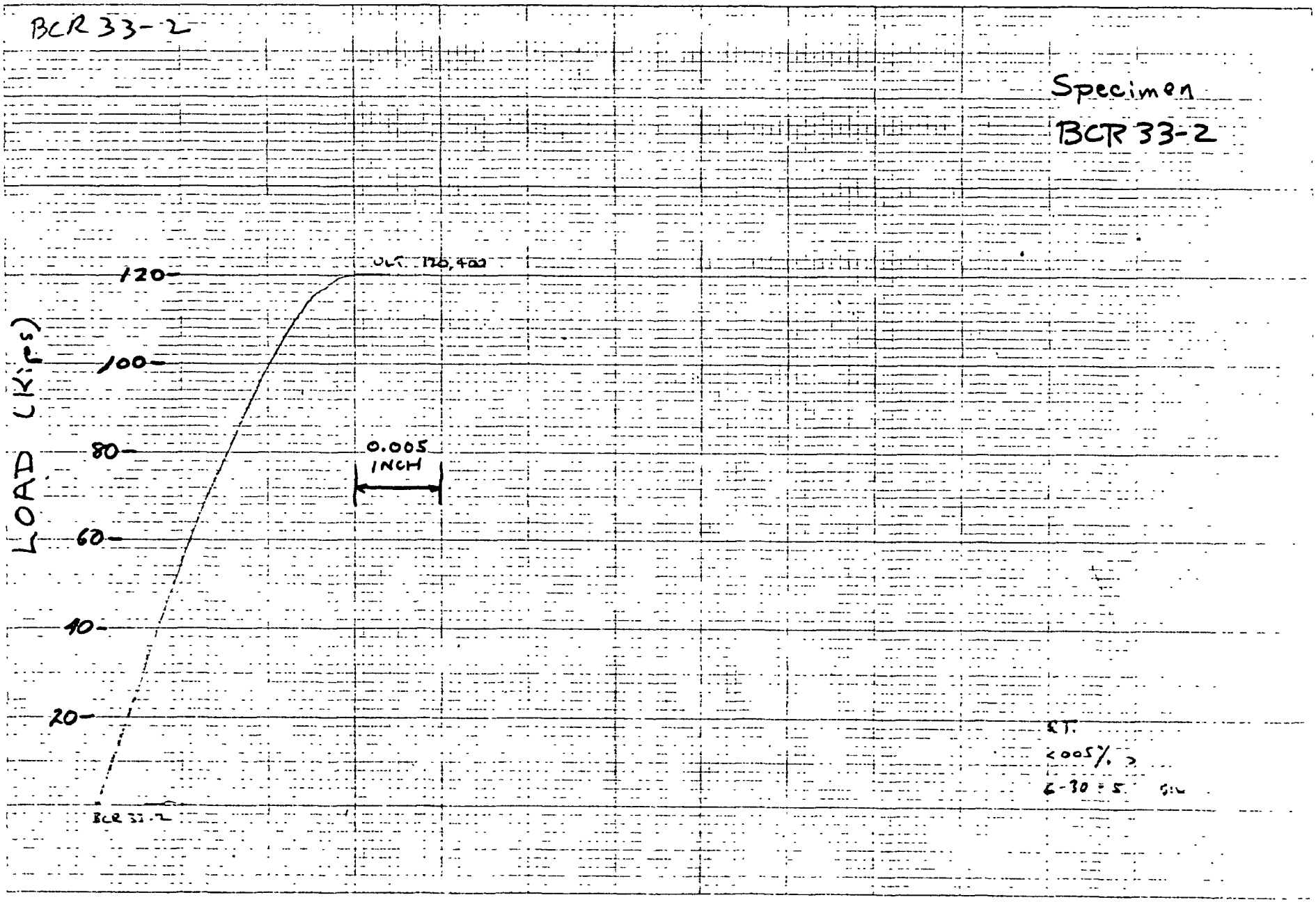

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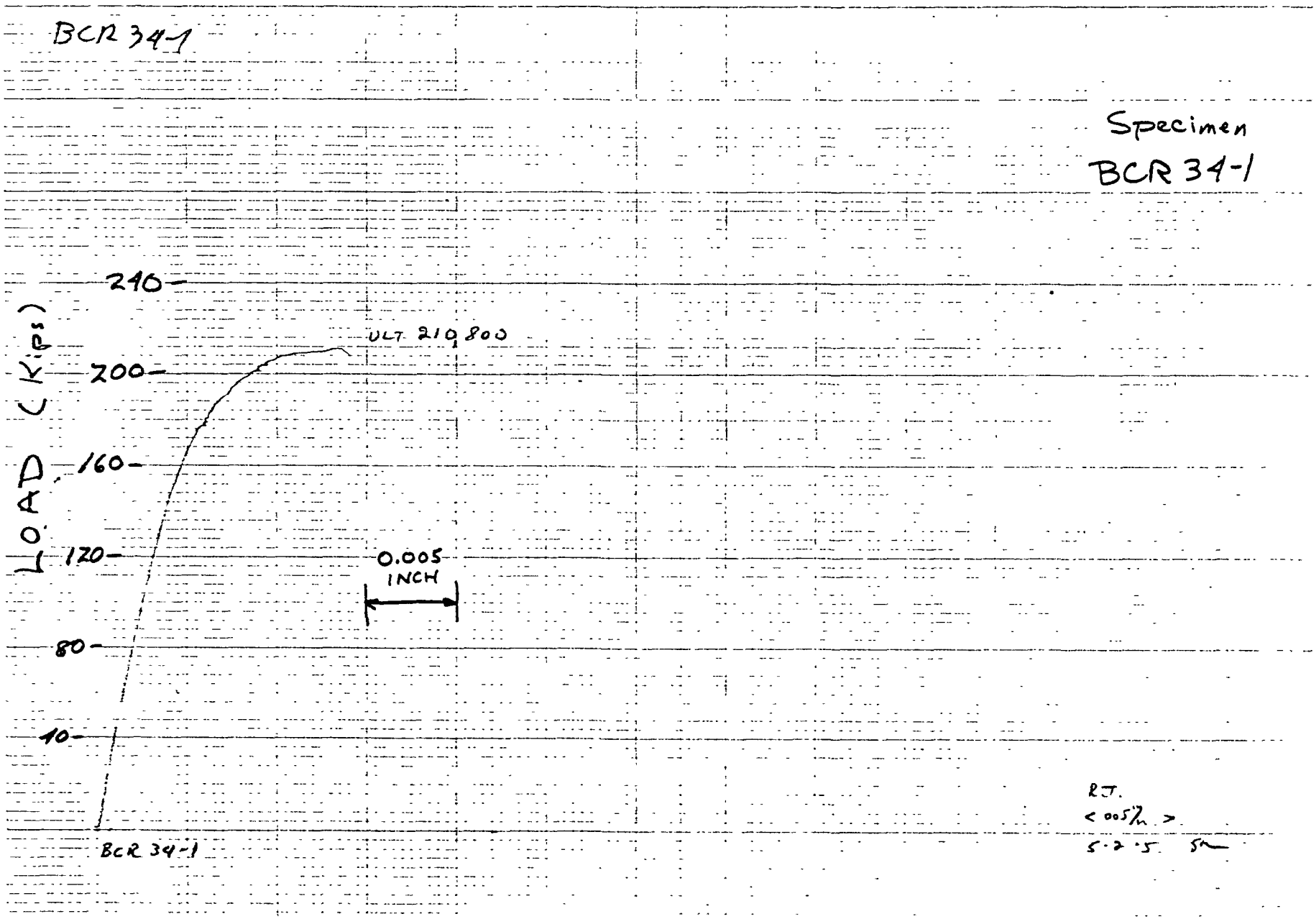

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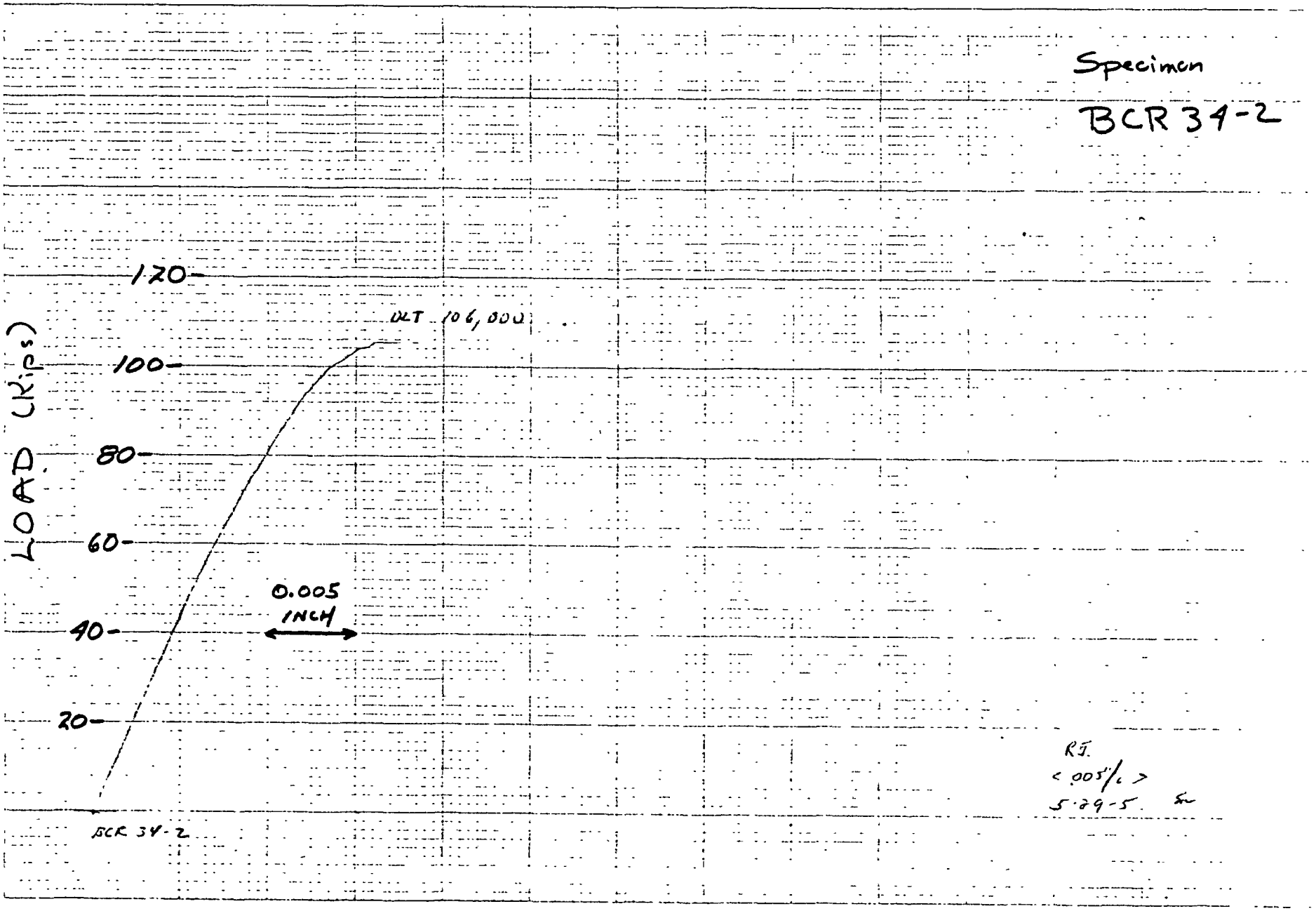

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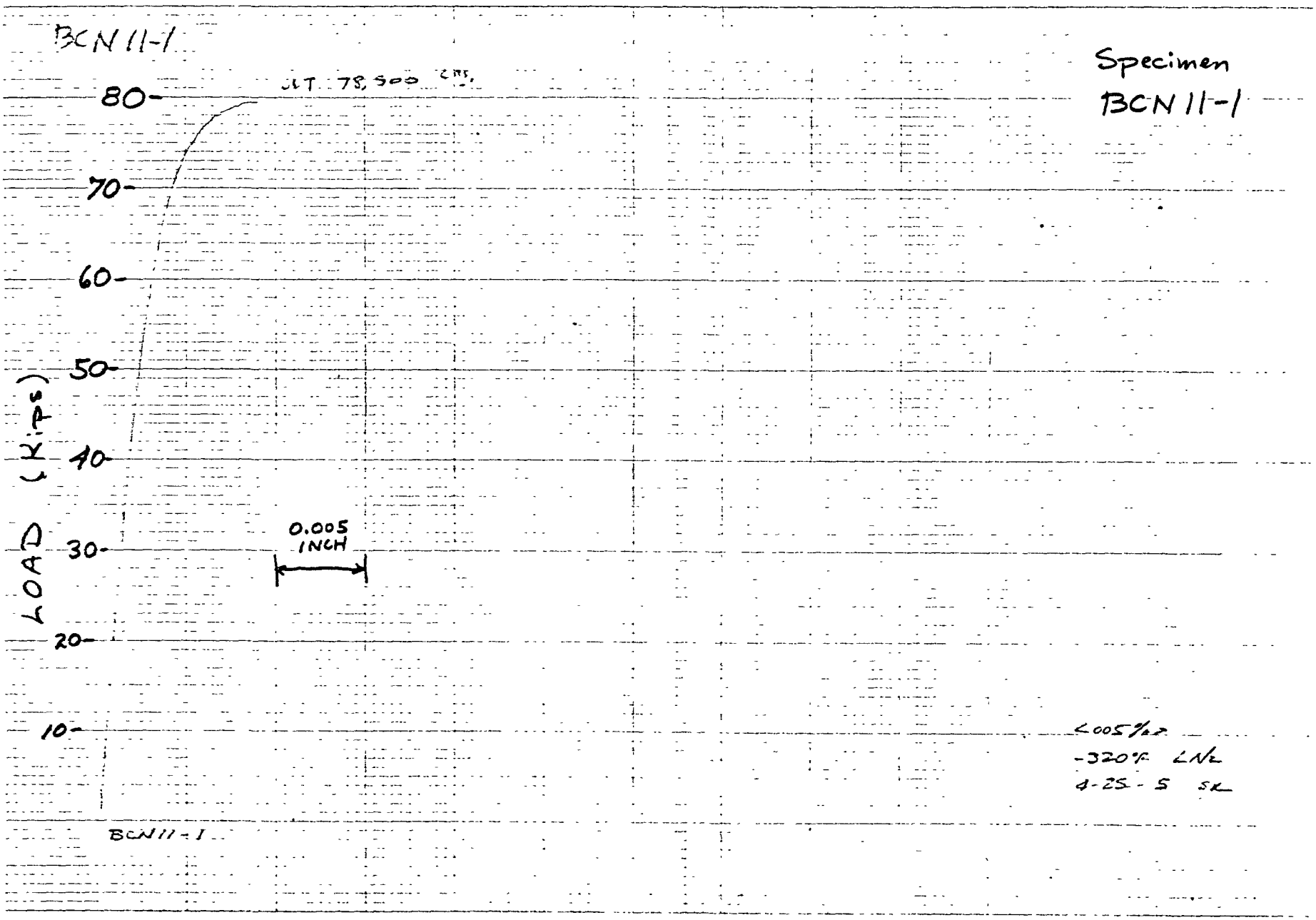
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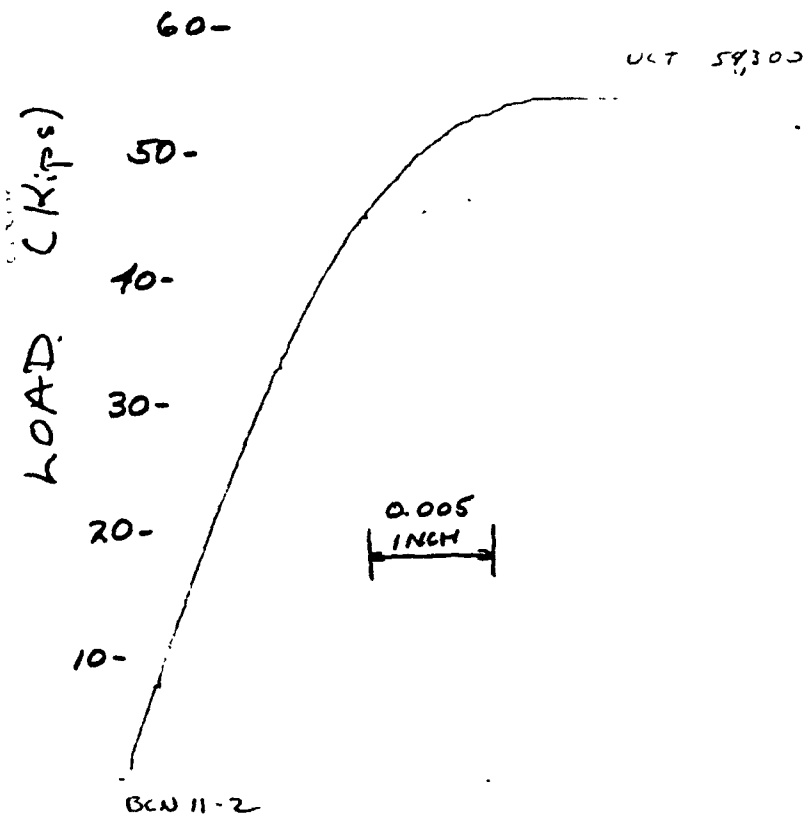

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5·2 ·5 5in

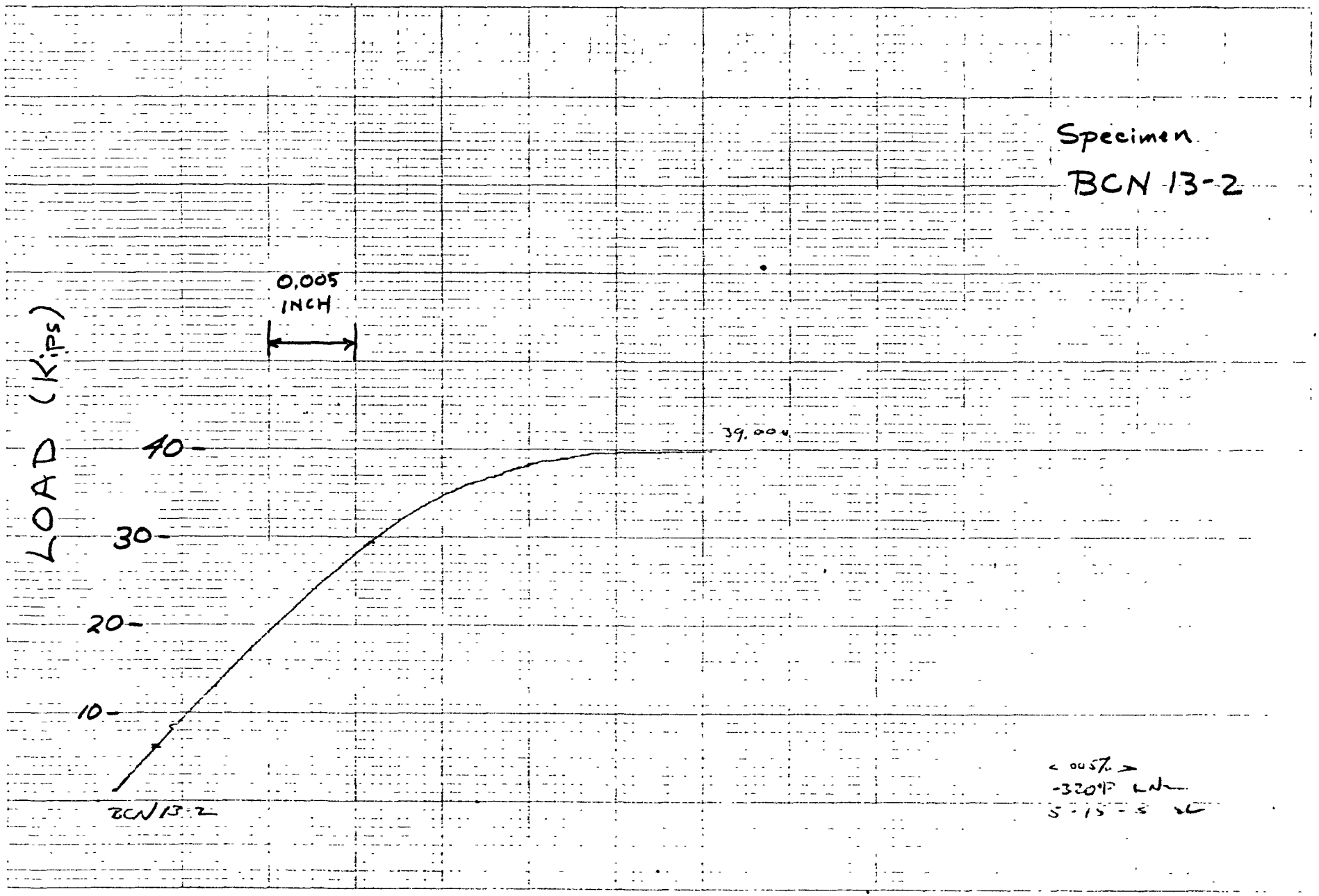

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5-29-5

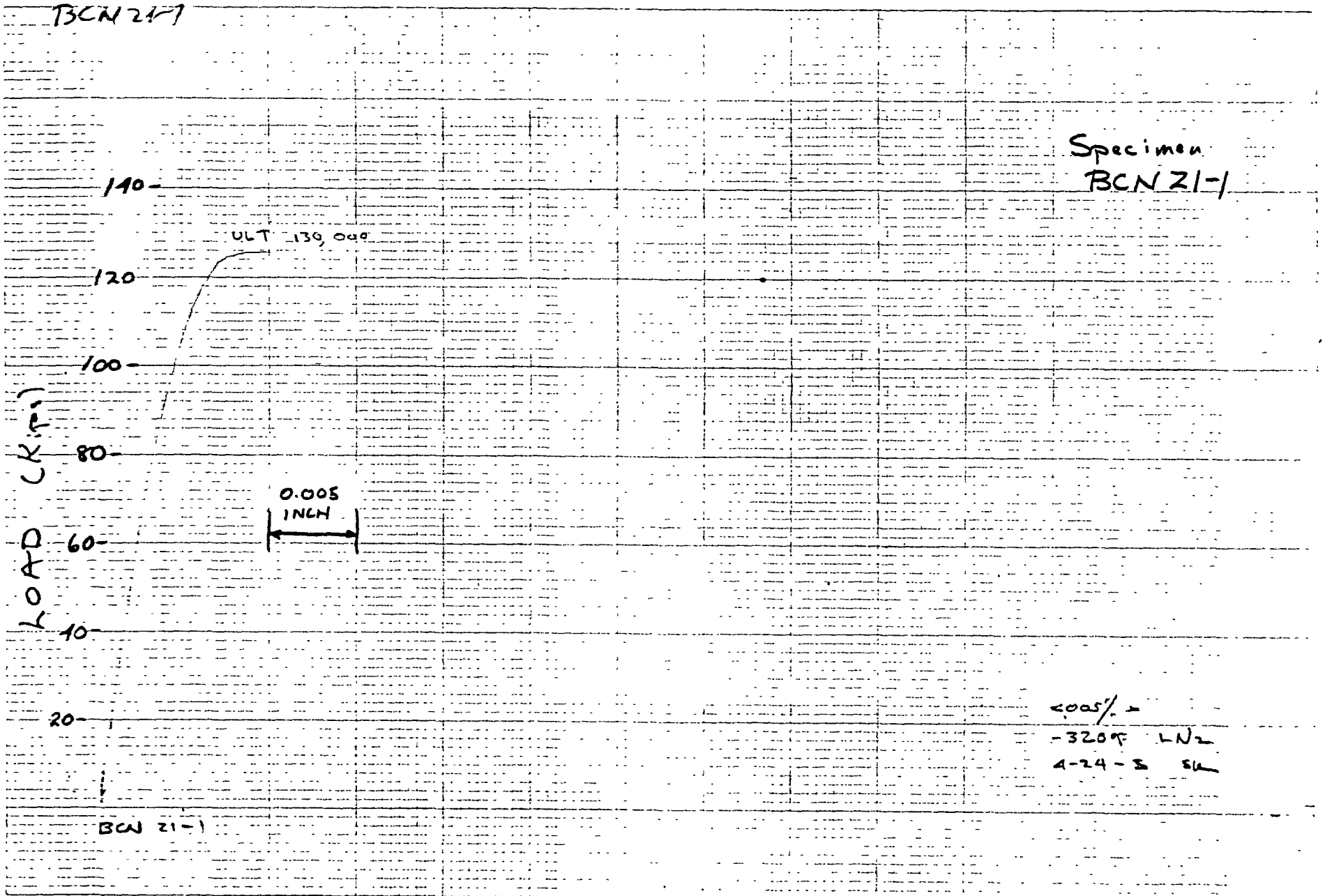

BCN 11-1
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70
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50
40
30
20
10
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Specimen
BCN 11-1
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-320°F LN2
4-25-5 SL

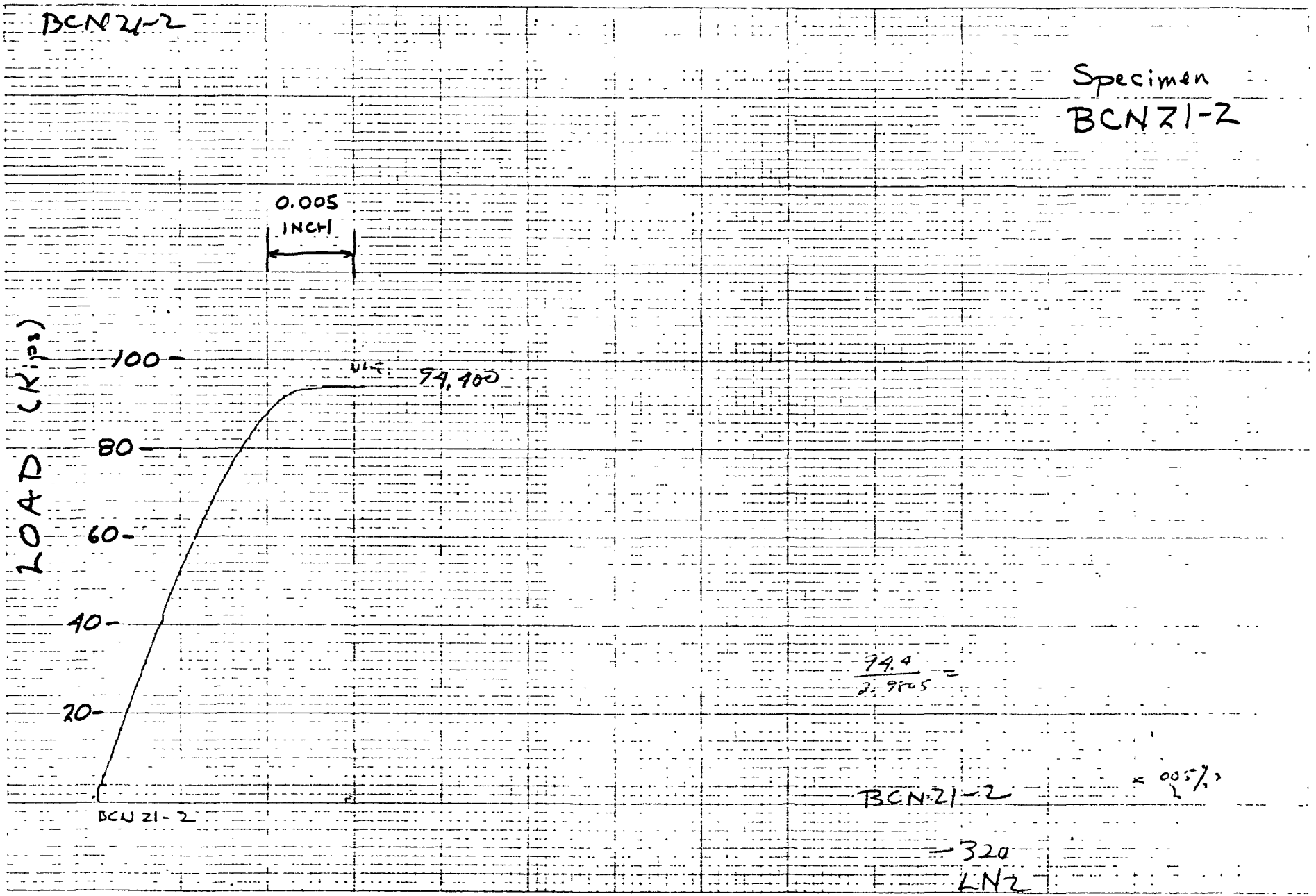
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Specimen
BCN 11-2

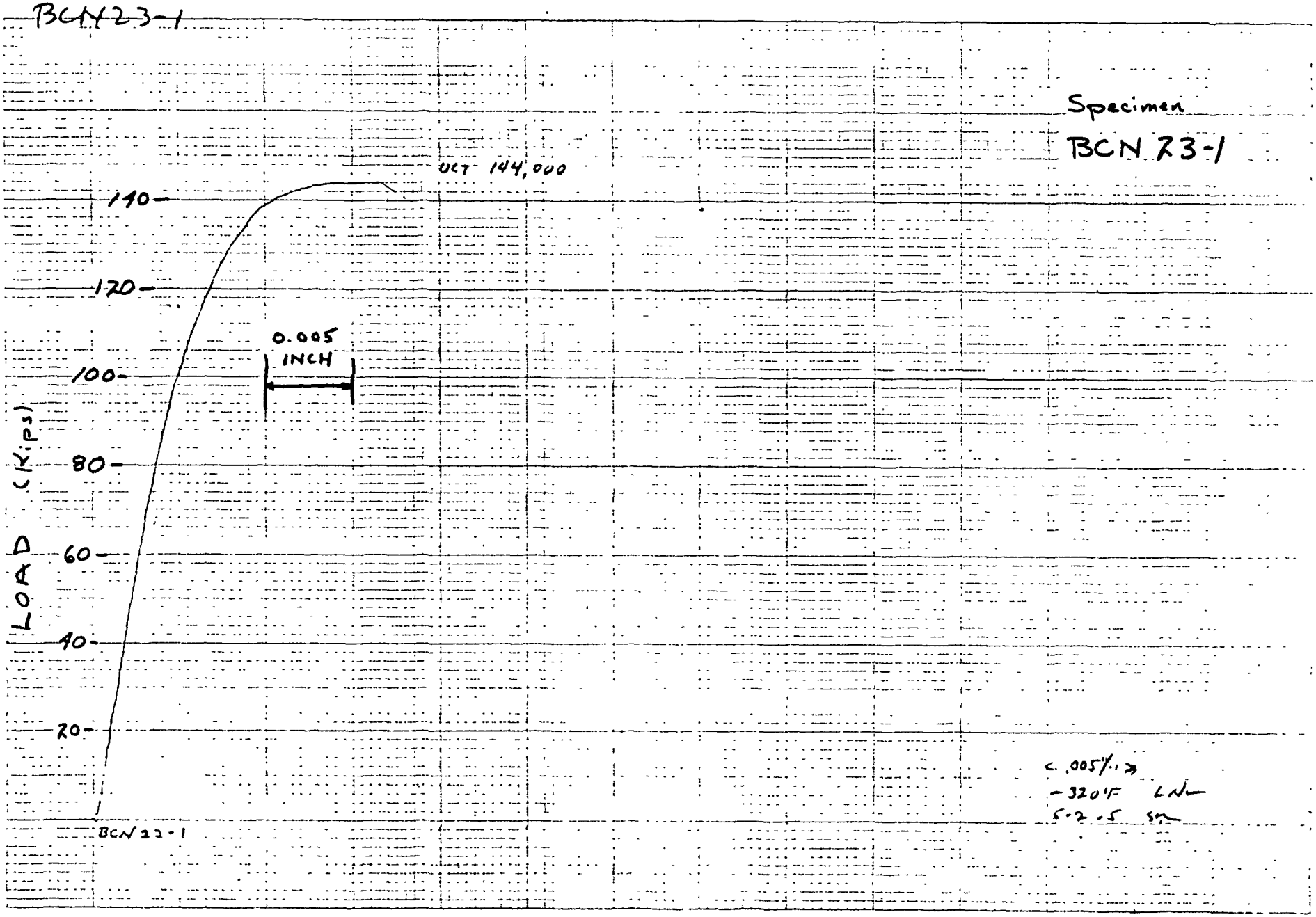


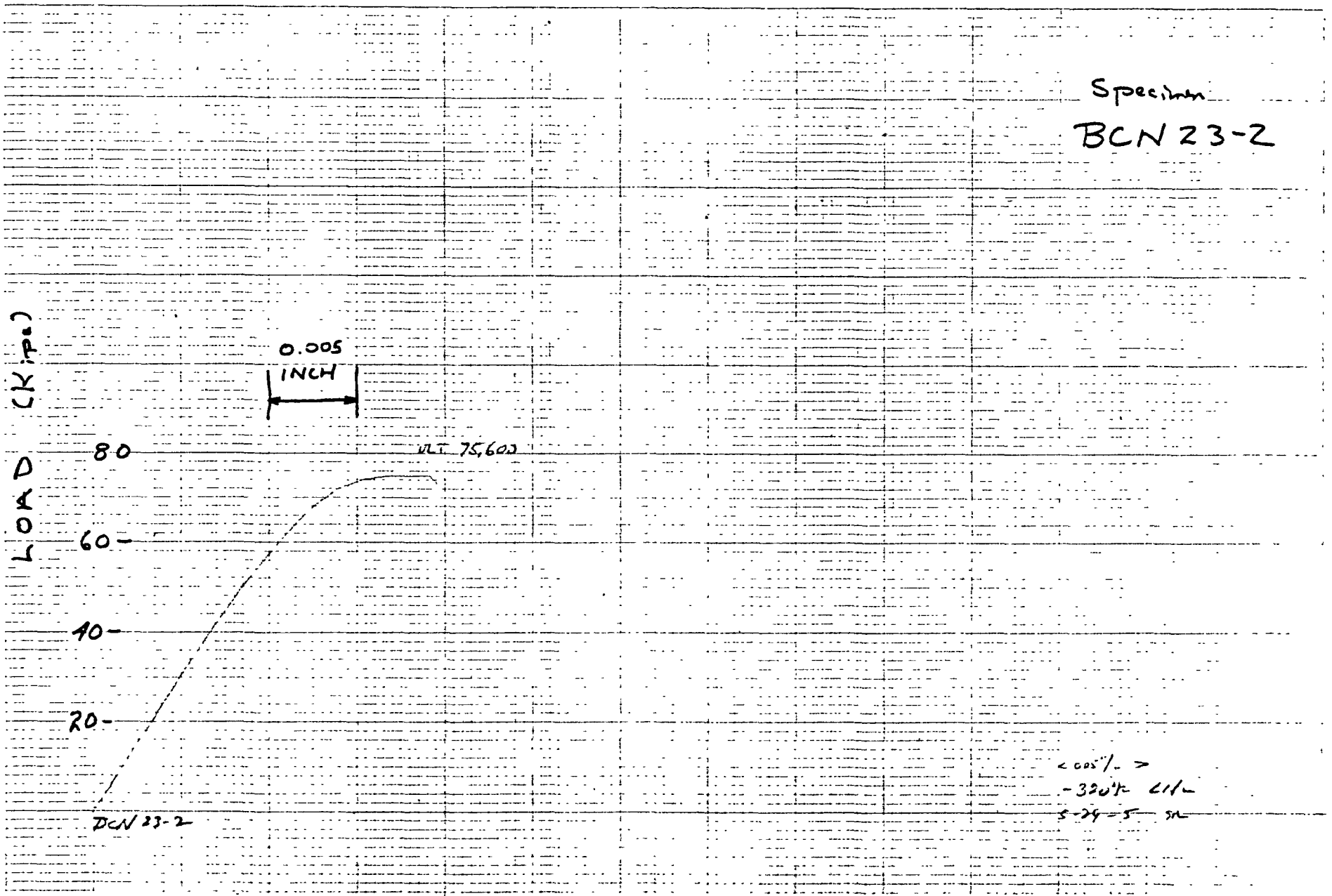

Specimen
BCN 13-2
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30
20
10
39,00#
BCN 13-2
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-320°F LN
5 - 15 - 5 sec

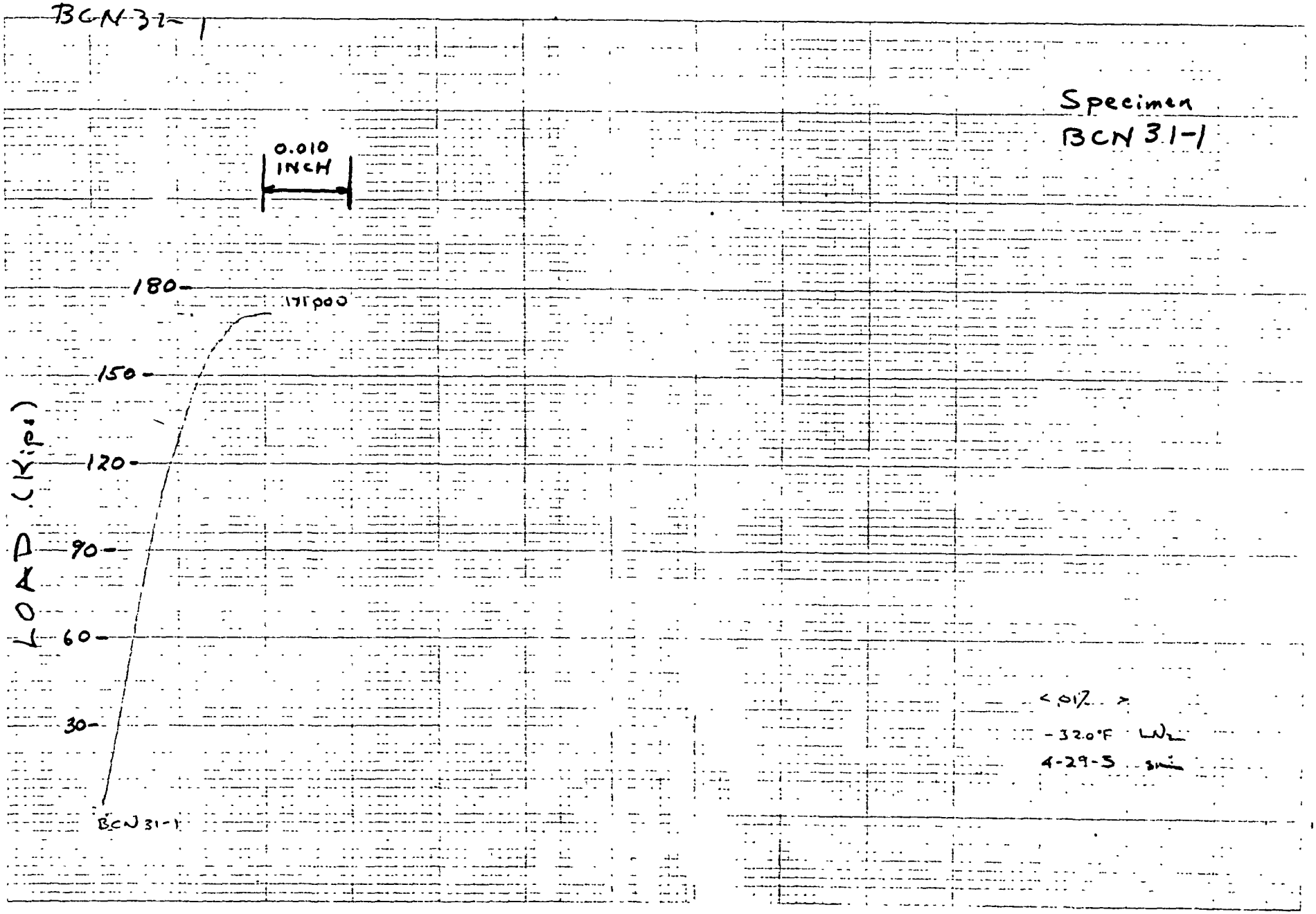

BCN 21-1
Specimen
BCN 21-1
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120
100
80
60
40
20
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-320°F LN2
4-24-5
BCN 21-1

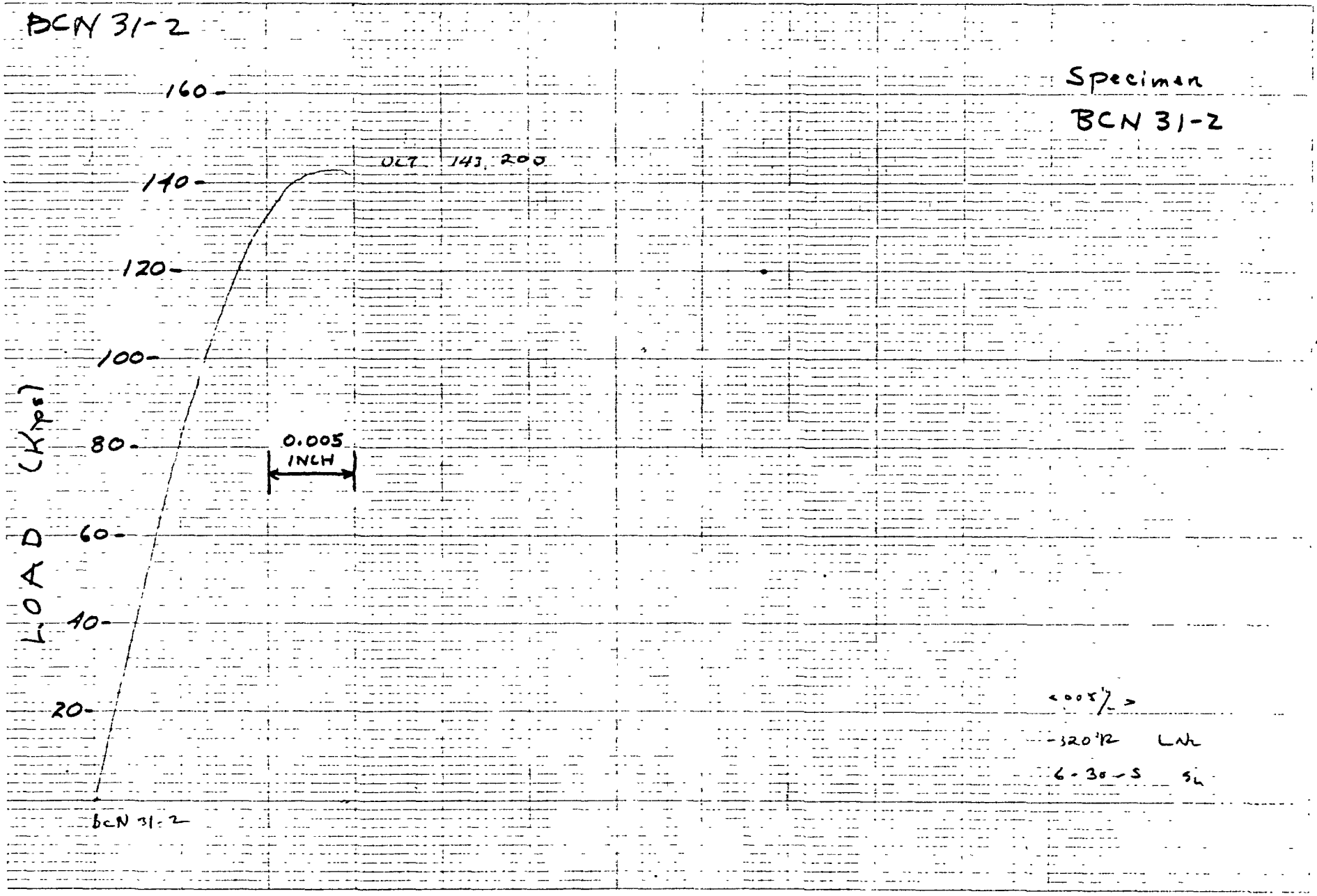

BCN 21-2
Specimen
BCN 21-2
0.005
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80
60
40
20
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BCN 21-2
BCN-21-2
-320
LN2

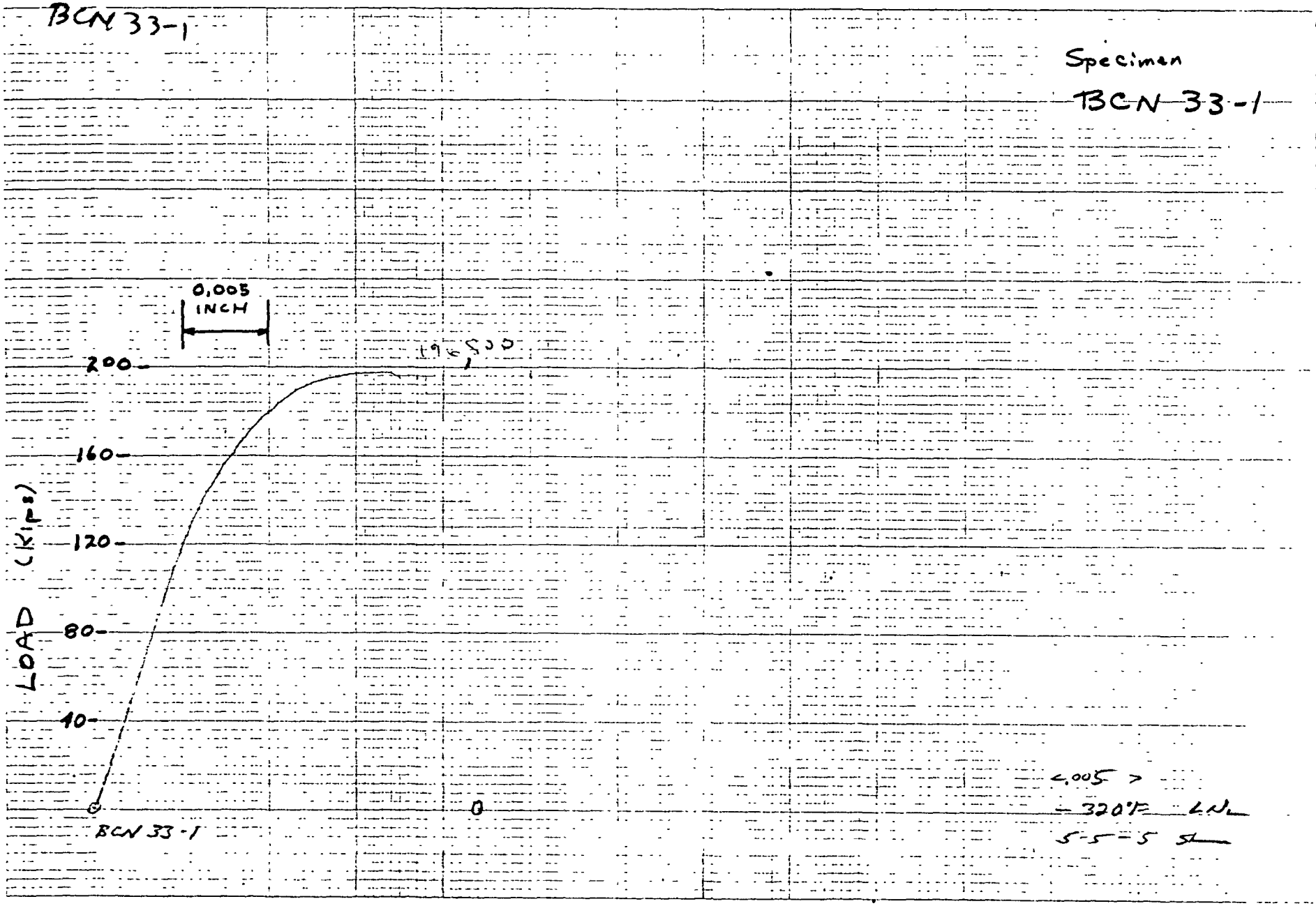
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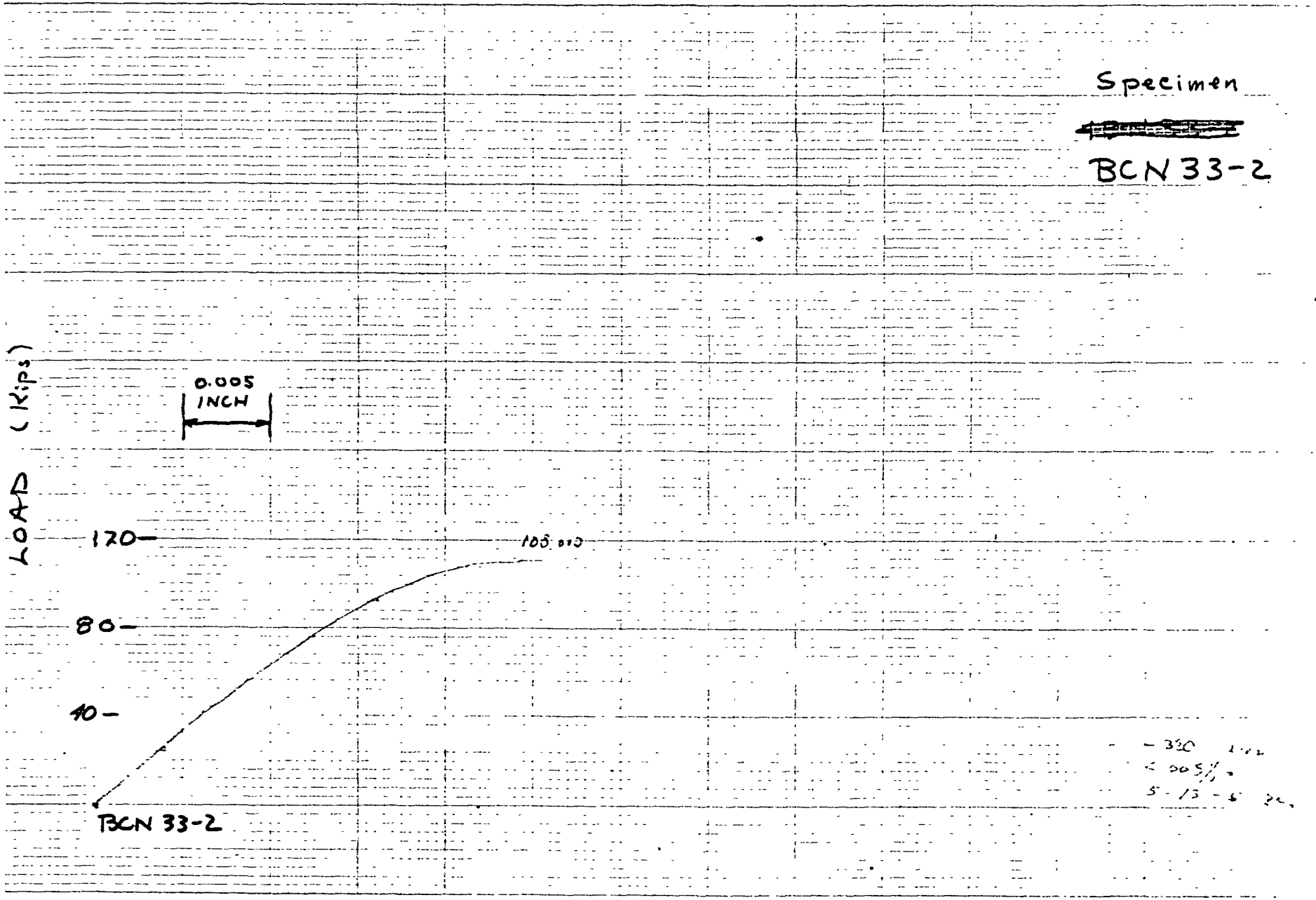

Specimen
BCN 23-1
ULT 144,000
140
120
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20
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INCH
LOAD (KIPS)
BCN 22-1
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-320°F LN
5-2-.5

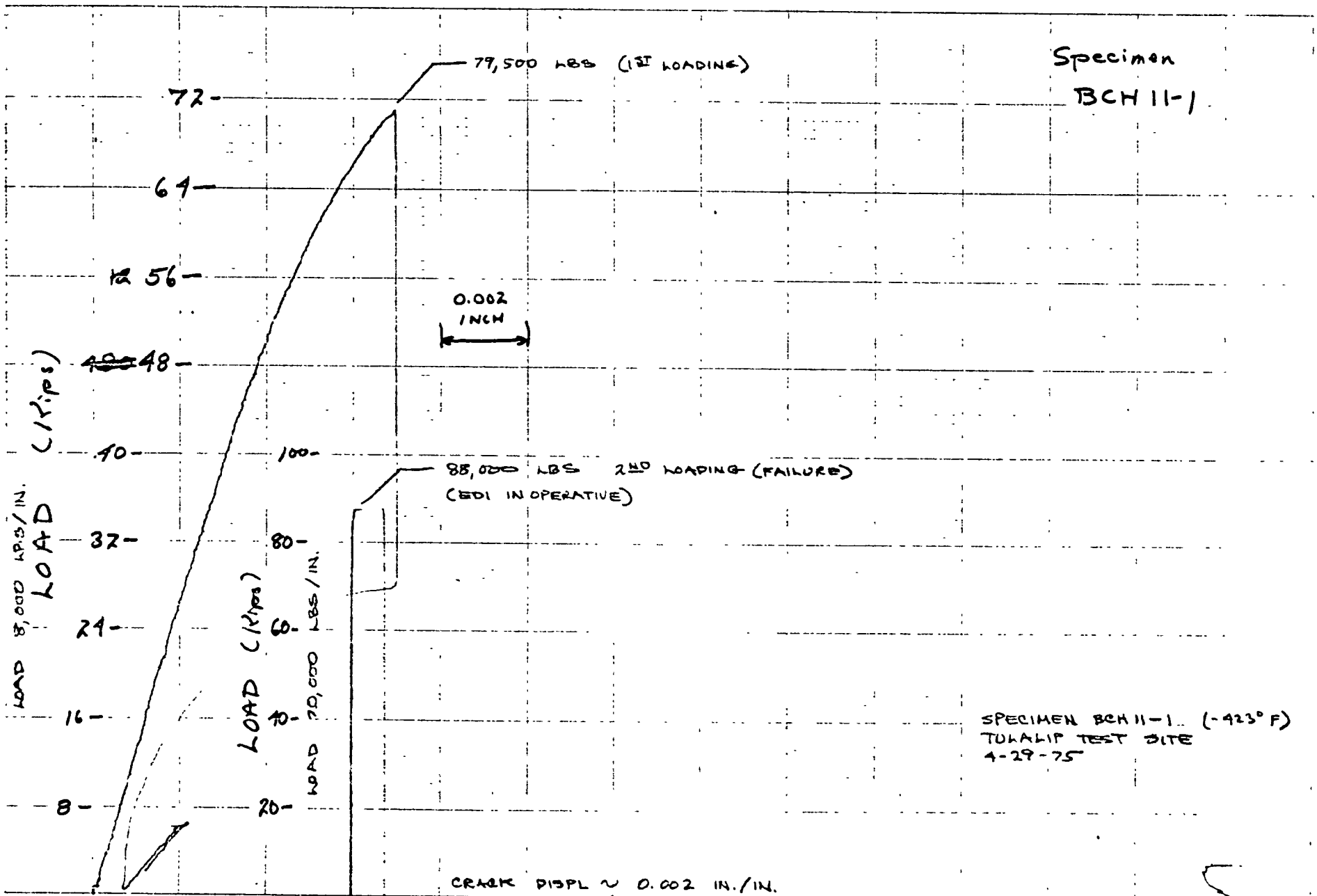

Specimen
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LOAD (KIPS)
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60
40
20
ULT 75,600
DCN 23-2
< 005"/- >
-320"/- 21/-
5-24-5 SK

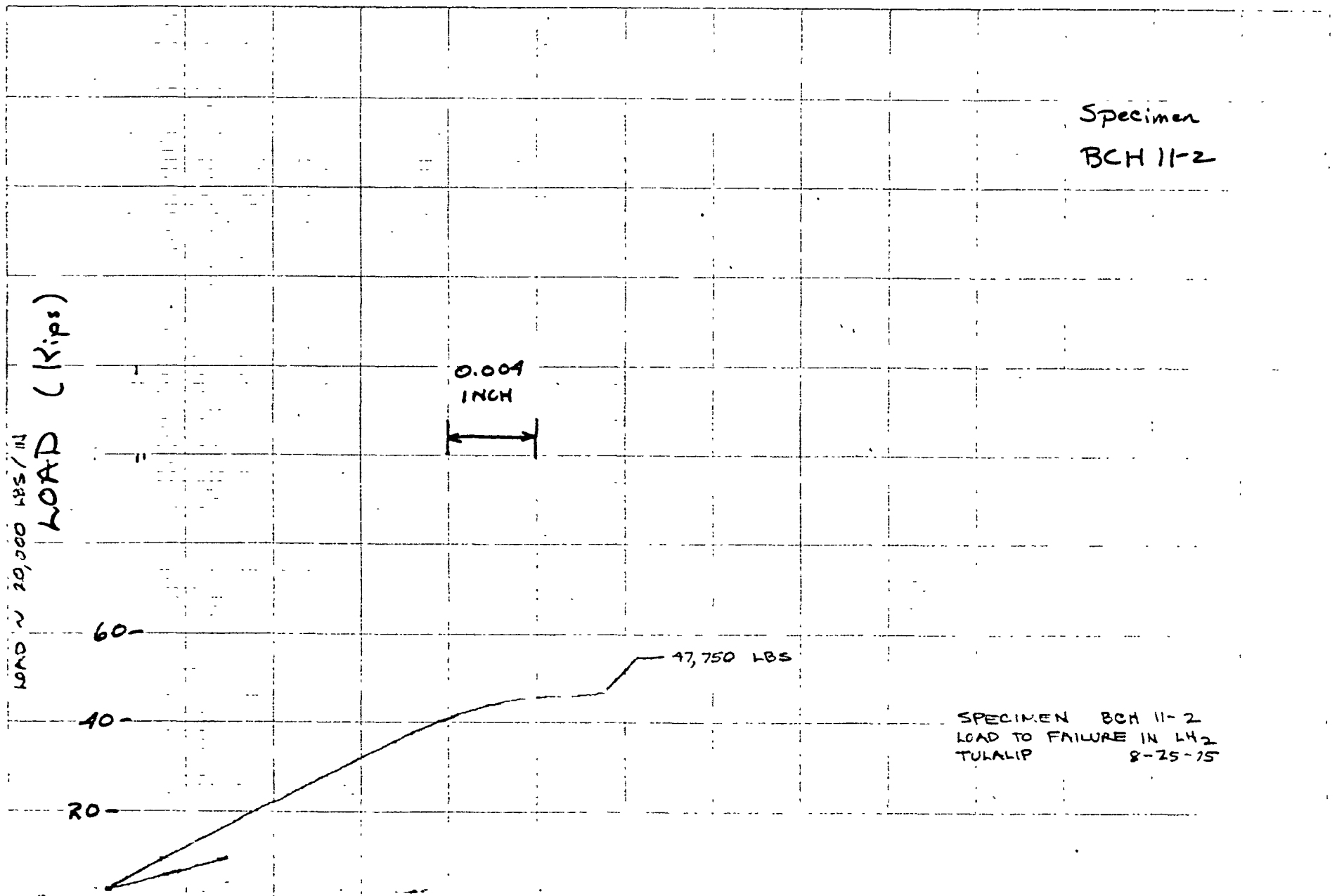

BCN-31-1
Specimen
BCN 31-1
0.010
INCH
180
150
120
90
60
30
LOAD (Kips)
171.00
BCN 31-1
< 01% >
-320°F LN2
4-29-5

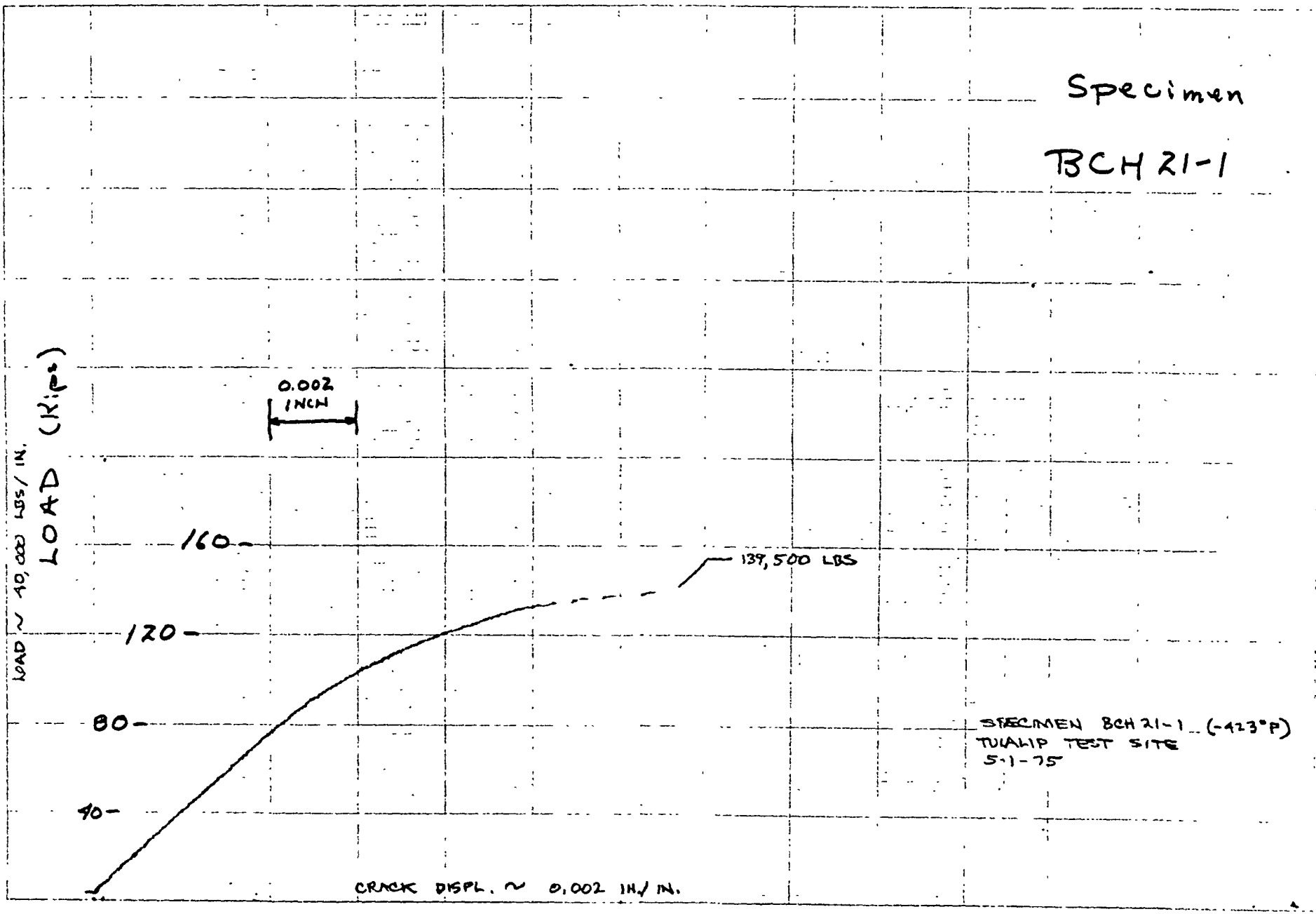

BCN 31-2
Specimen
BCN 31-2
160
140
120
100
80
60
40
20
LOAD (Kips)
0.005
INCH
143,200
<.005"/_>
-320°R LN2
6-30-S
BCN 31-2

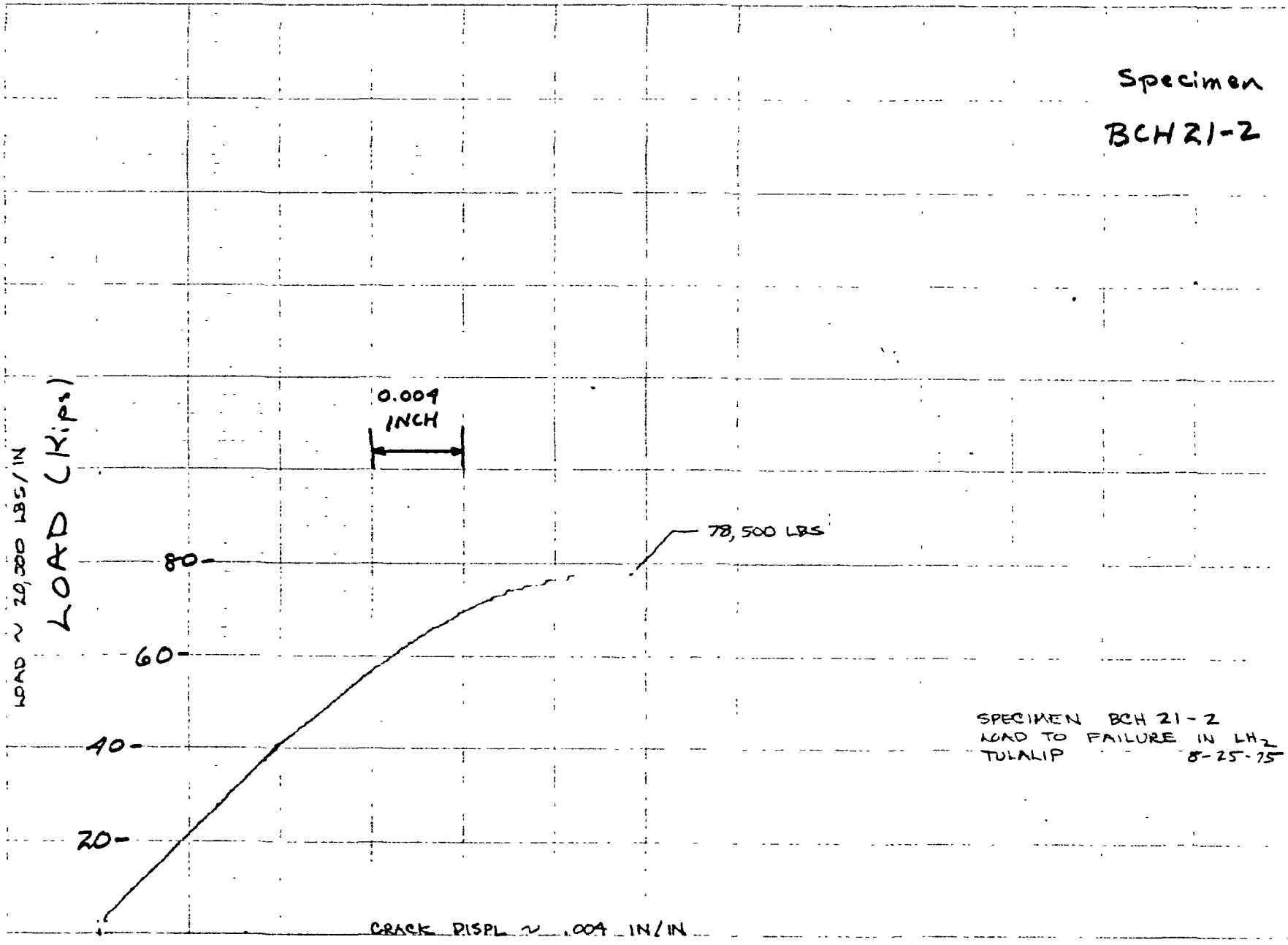

BCN 33-1
Specimen
BCN-33-1
0.005 INCH
200
160
120
80
40
0
LOAD (KIPS)
BCN 33-1
<.005 >
-320°F LN
5-5-5 sk

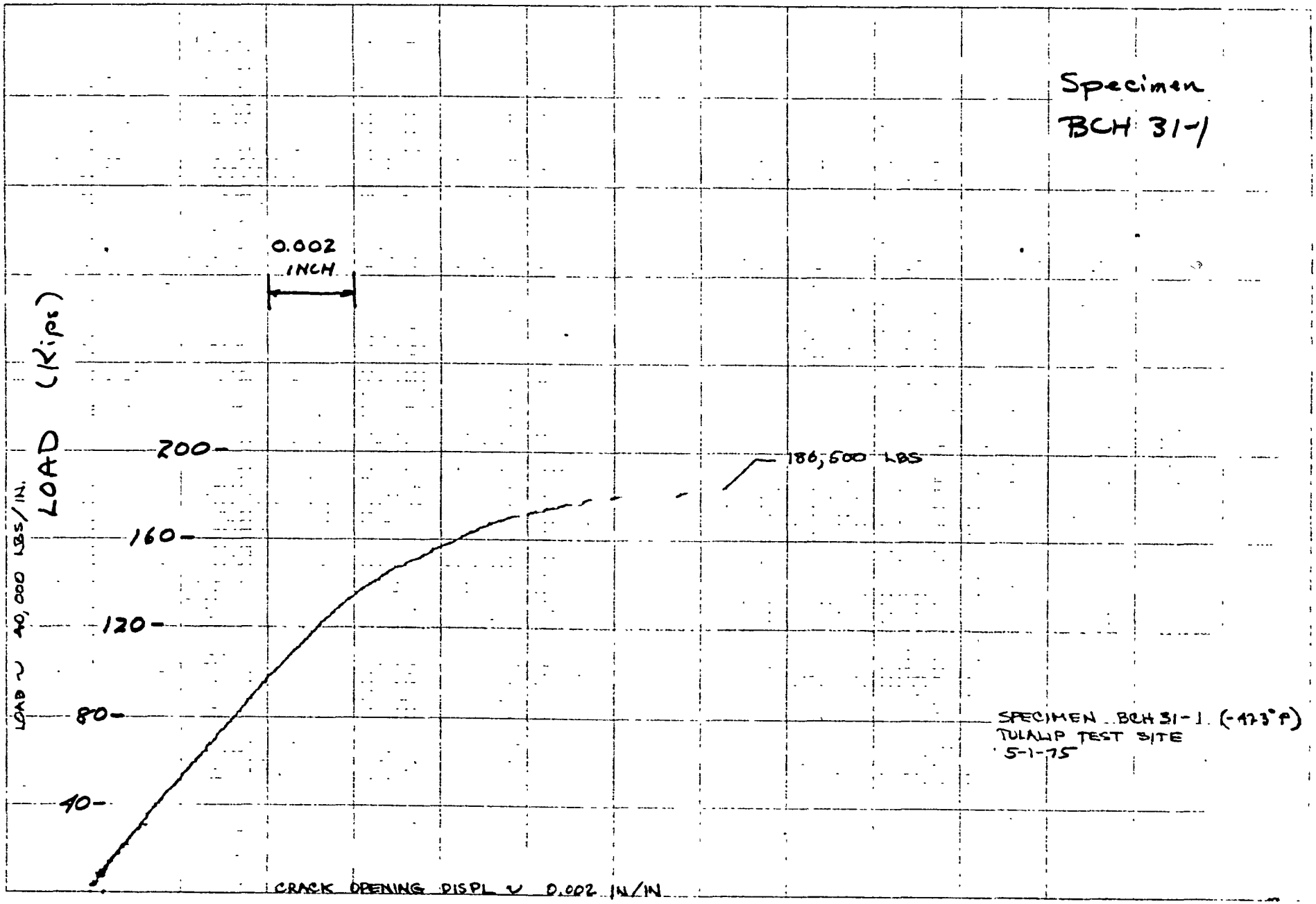

Specimen
BCN 33-2
0.005 INCH
LOAD (Kips)
120
80
40
BCN 33-2

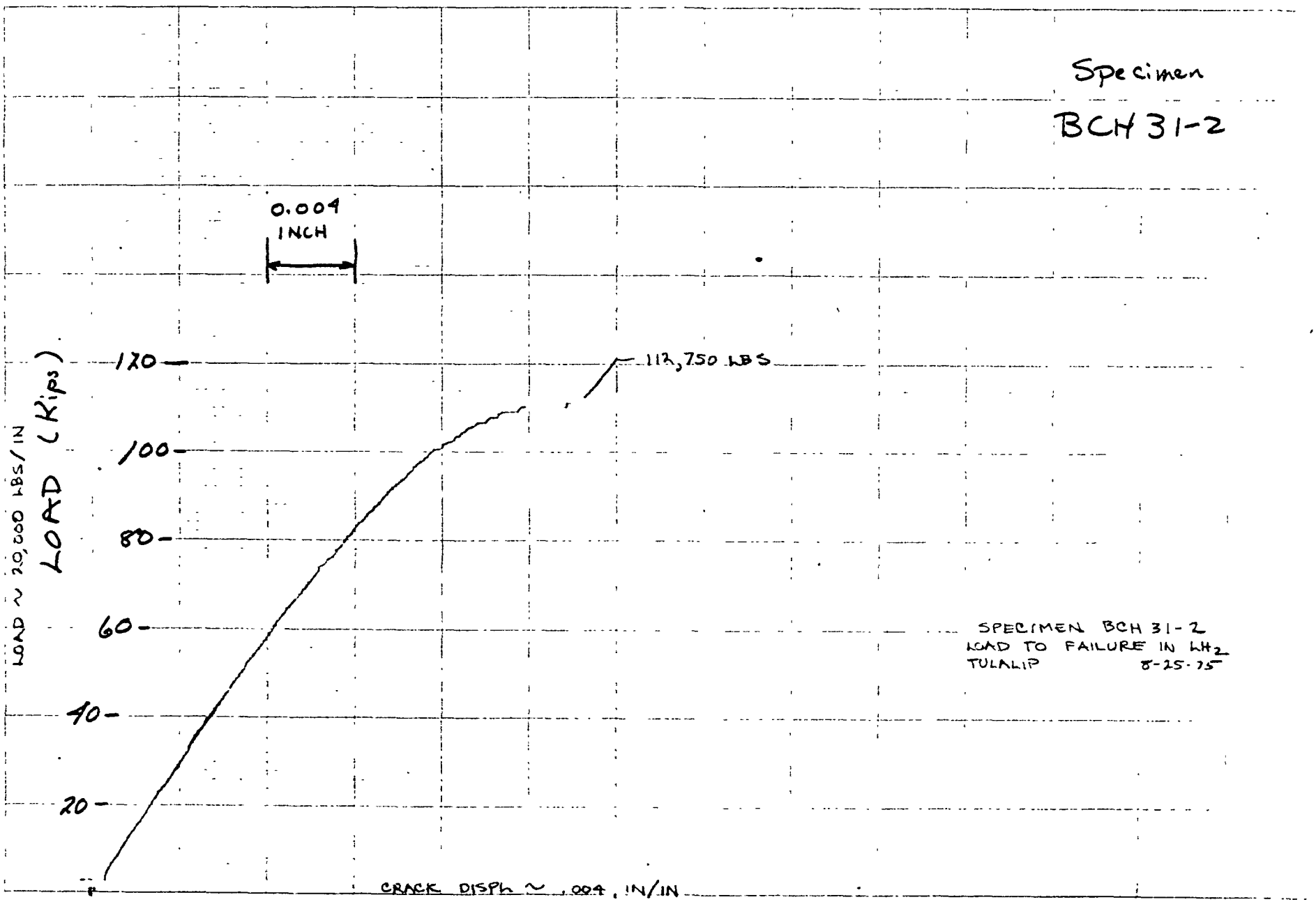

Specimen
BCH 11-1
79,500 LBS (1ST LOADING)
88,000 LBS 2ND LOADING (FAILURE)
(EDI IN OPERATIVE)
0.002
INCH
LOAD (Kips)
LOAD 8,000 LBS/IN.
LOAD (Kips)
LOAD 20,000 LBS/IN.
72
64
56
48
40
32
24
16
8
100
80
60
40
20
SPECIMEN BCH 11-1 (-423° F)
TULALIP TEST SITE
4-29-75
CRACK DISPL ~ 0.002 IN./IN.

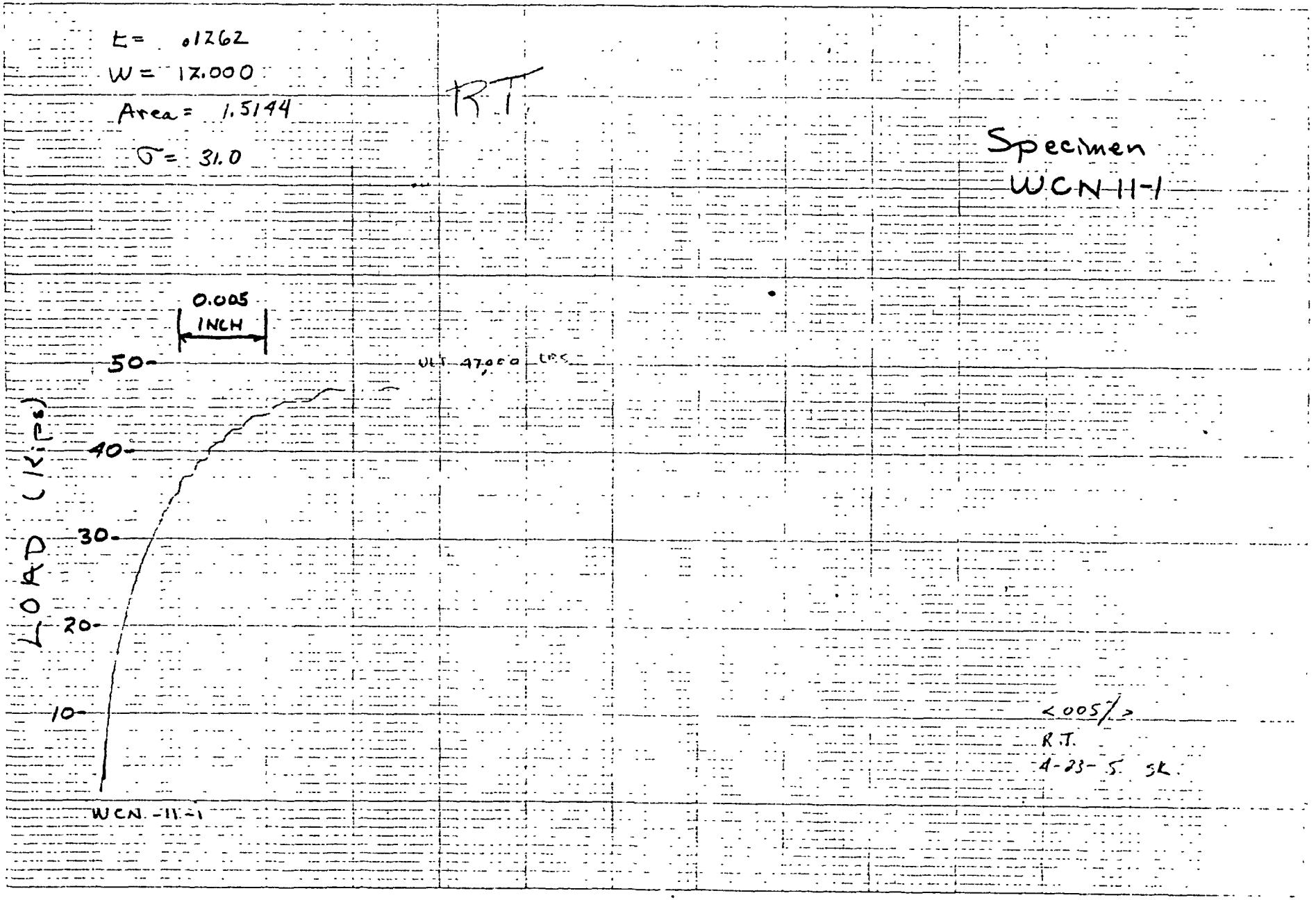

Specimen
BCH 11-2
LOAD (Kips)
LOAD ~ 20,000 LBS/IN
0.004
INCH
60
40
20
47,750 LBS
SPECIMEN BCH 11-2
LOAD TO FAILURE IN LH2
TULALIP 8-25-15

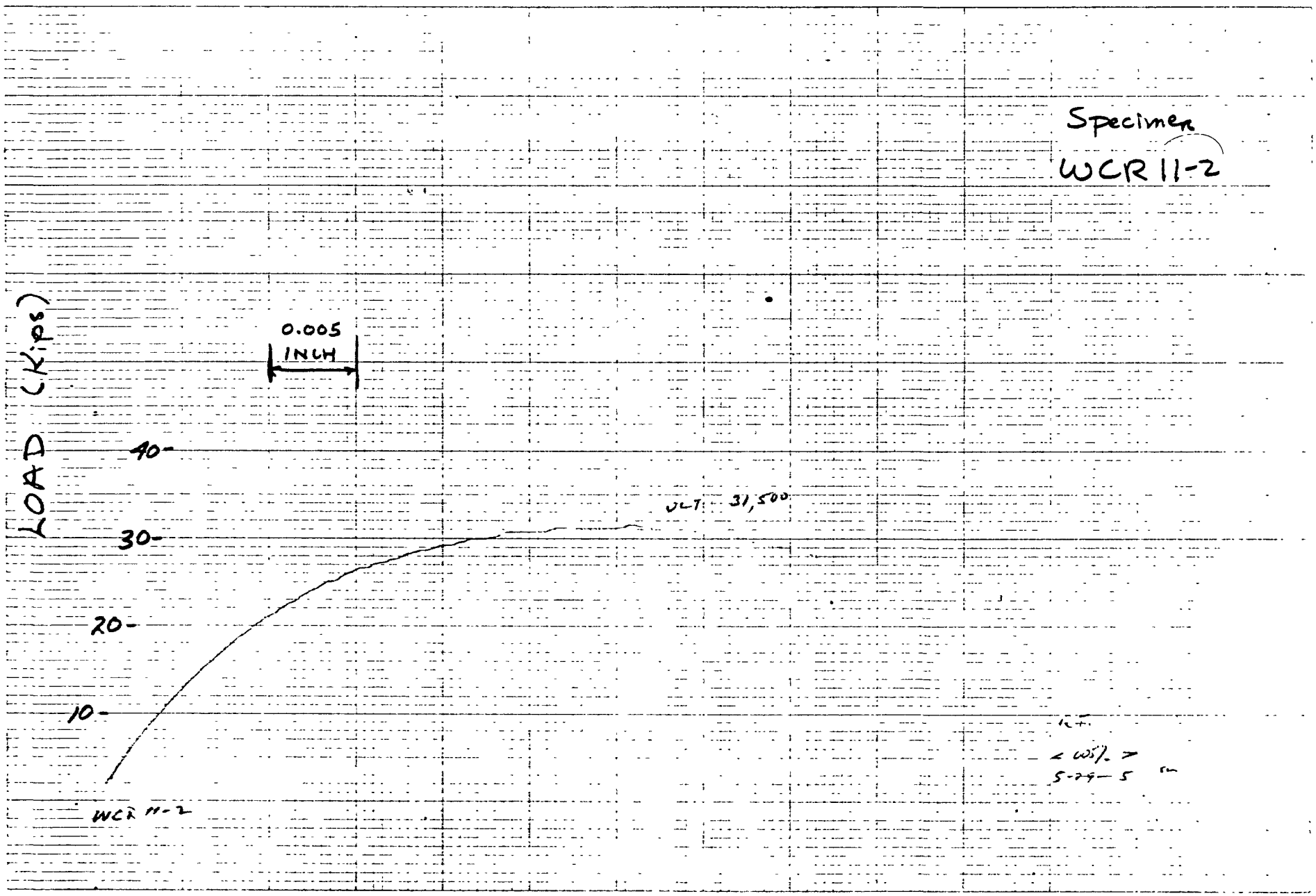

Specimen
BCH 21-1
0.002 INCH
LOAD (Kips)
LOAD ~ 40,000 LBS/IN.
160
120
80
40
139,500 LBS
CRACK DISPL. ~ 0.002 IN./IN.
SPECIMEN BCH 21-1 (-423°F)
TULALIP TEST SITE
5-1-75


Specimen
BCH 21-2
0.009
INCH
78,500 LBS
80
60
40
20
LOAD (Kips)
LOAD ~ 20,000 LBS/IN
CRACK DISPL ~ .004 IN/IN
SPECIMEN BCH 21-2
LOAD TO FAILURE IN LH2
TULALIP
8-25-75


Specimen
BCH 31-1
0.002
INCH
LOAD (Kips)
LOAD ~ 40,000 LBS/IN.
200
160
120
80
40
186,500 LBS
SPECIMEN BCH 31-1 (-173°F)
TULALIP TEST SITE
5-1-75
CRACK OPENING DISPL ~ 0.002 IN/IN


Specimen
BCH 31-2
0.004
INCH
LOAD (Kips)
LOAD ~ 20,000 LBS/IN
120
100
80
60
40
20
112,750 LBS
CRACK DISPL ~ .004 . IN/IN
SPECIMEN BCH 31-2
LOAD TO FAILURE IN LH2
TULALIP
8-25-75

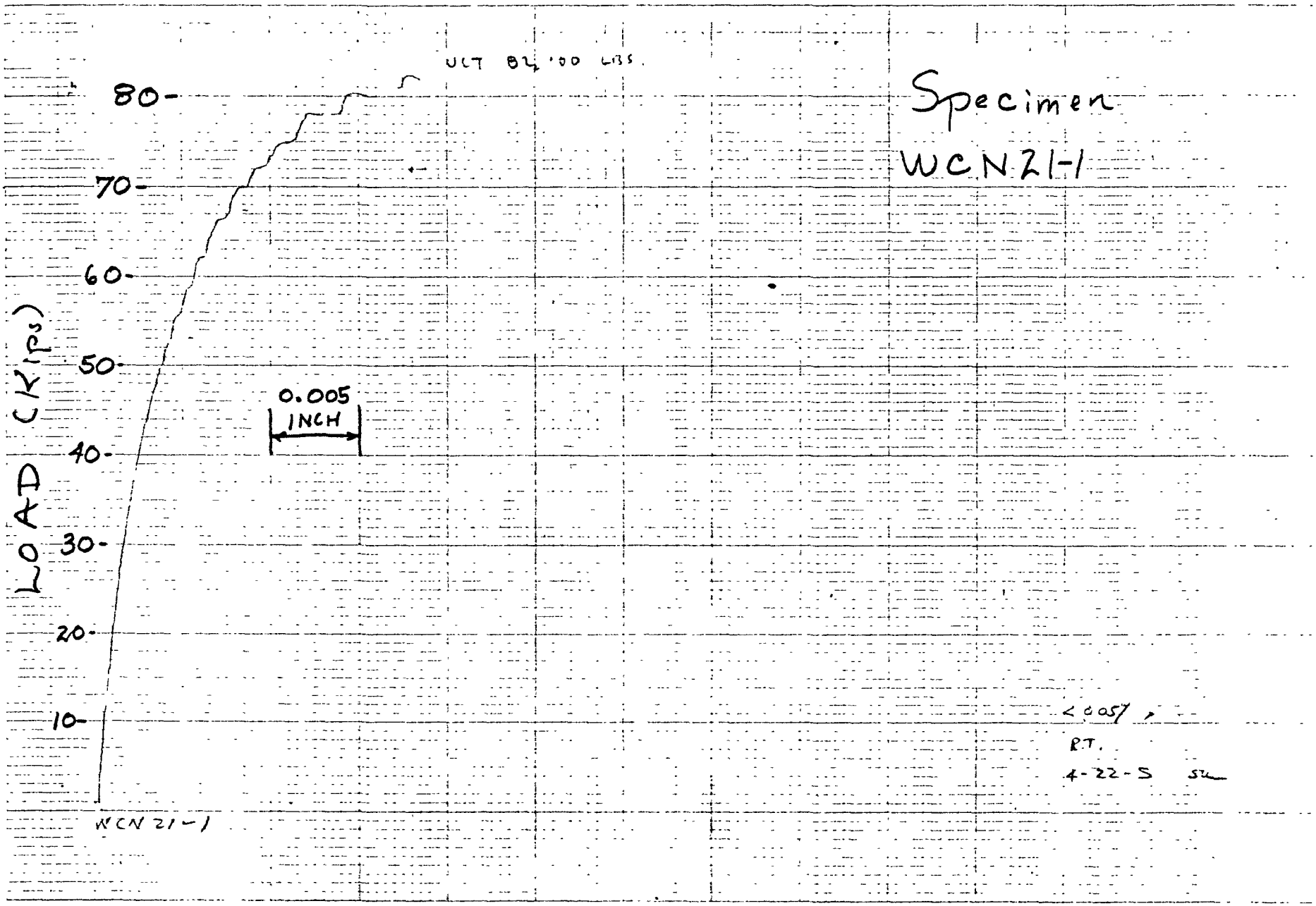

t = .1262
W = 12.000
Area = 1.5144
σ = 31.0
R.T.
Specimen
WCN II-1
0.005
INCH
ULT 47,000 LBS
50
40
30
20
10
LOAD (KIPS)
WCN-II-1
<.005/>
R.T.
4-23-5 SK.

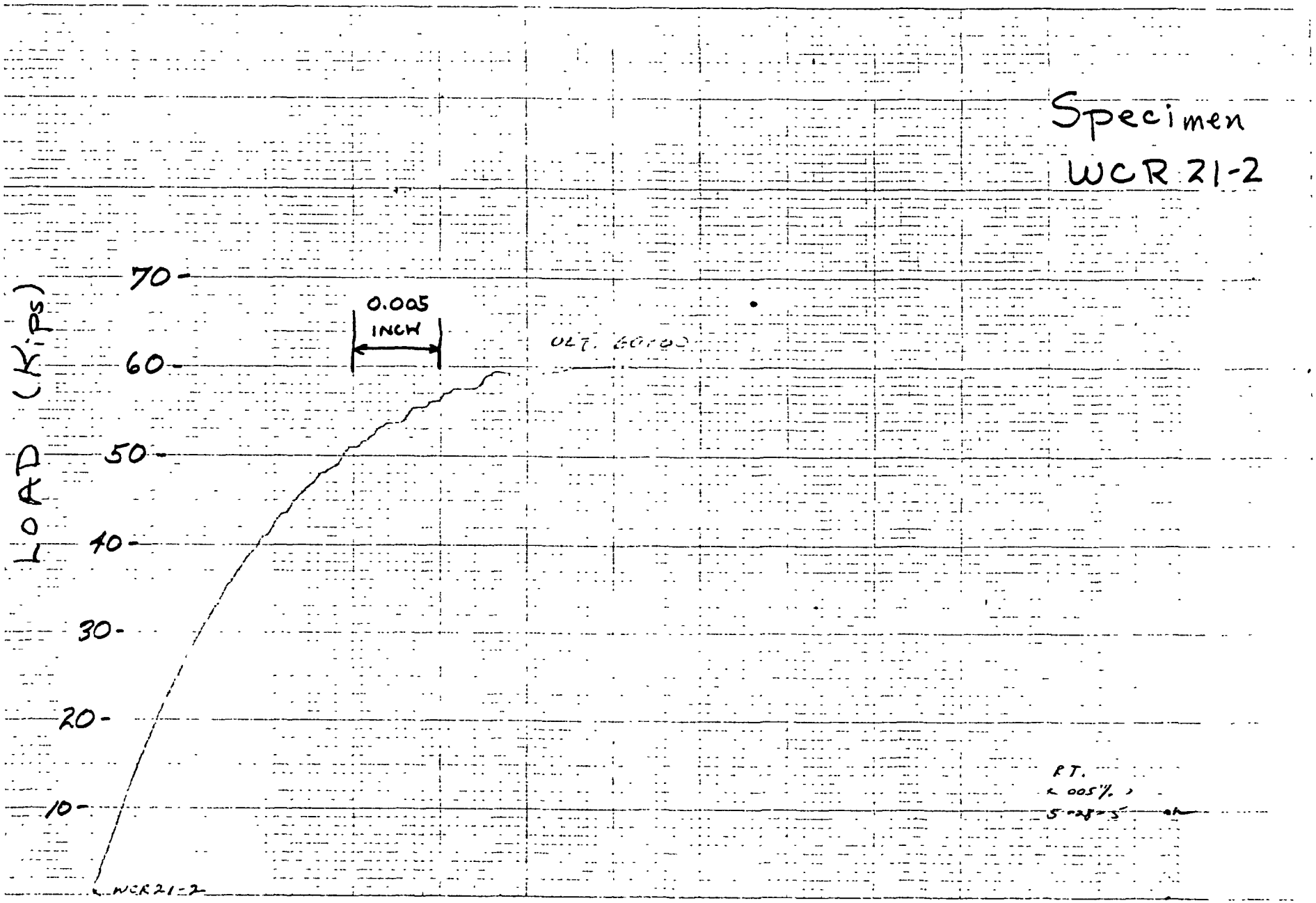

Specimen
WCR 11-2
0.005
INCH
LOAD (Kips)
40
30
20
10
ULT. 31,500
WCR 11-2

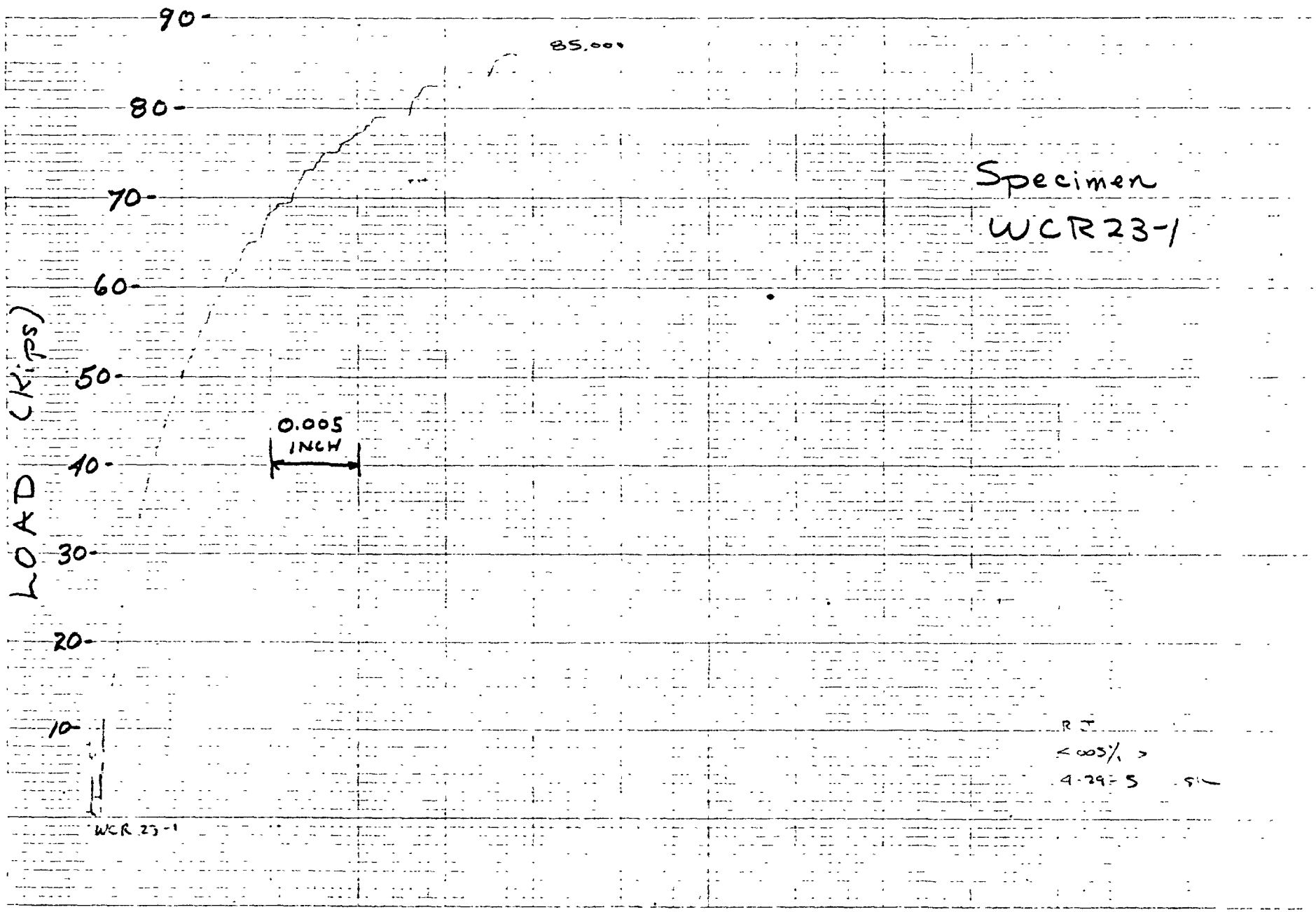
4/0/03

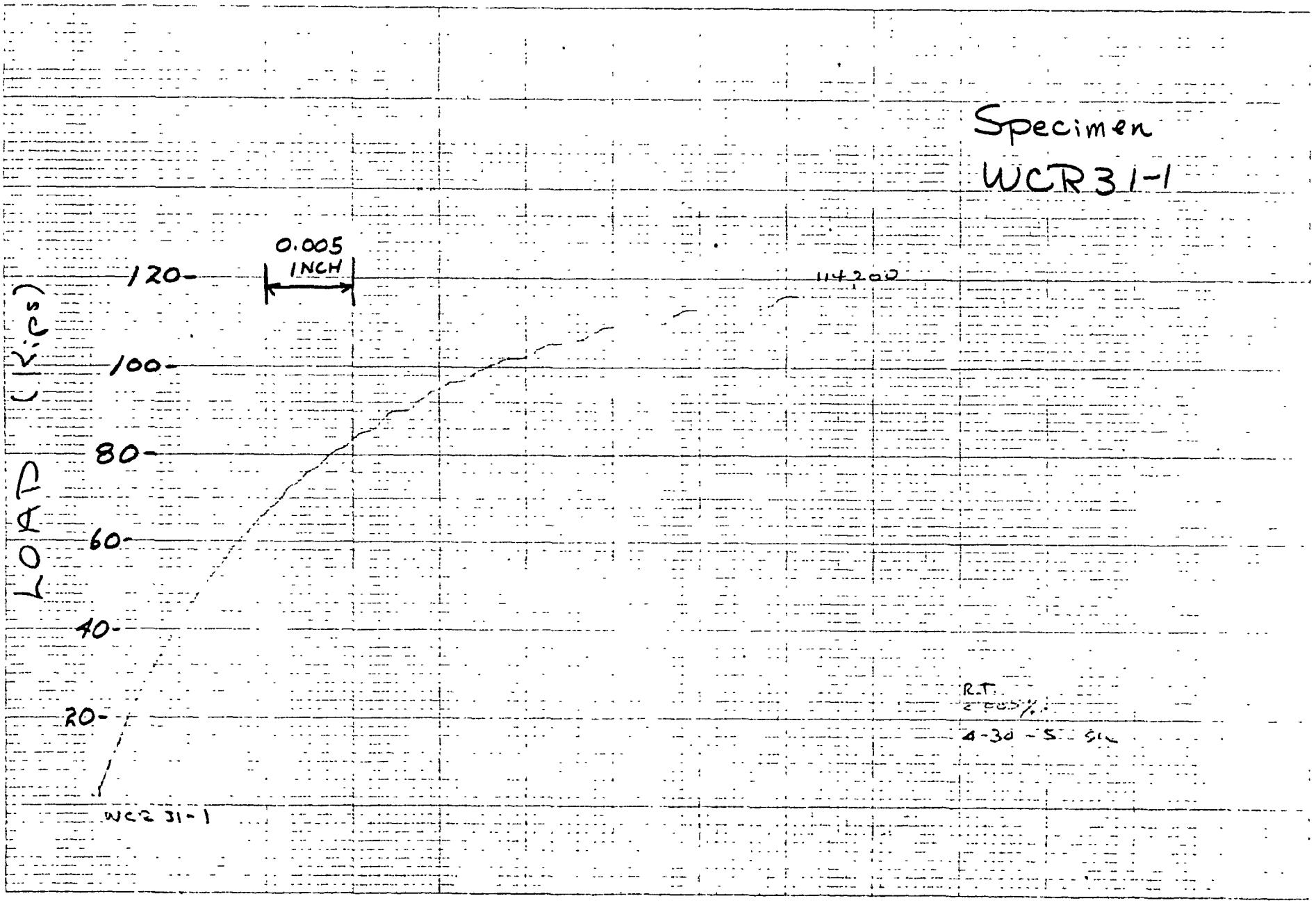
Specimen
WCR 13-1
LOAD (Kips)
60
50
40
30
20
10
50,500 LBS.
0.005
INCH

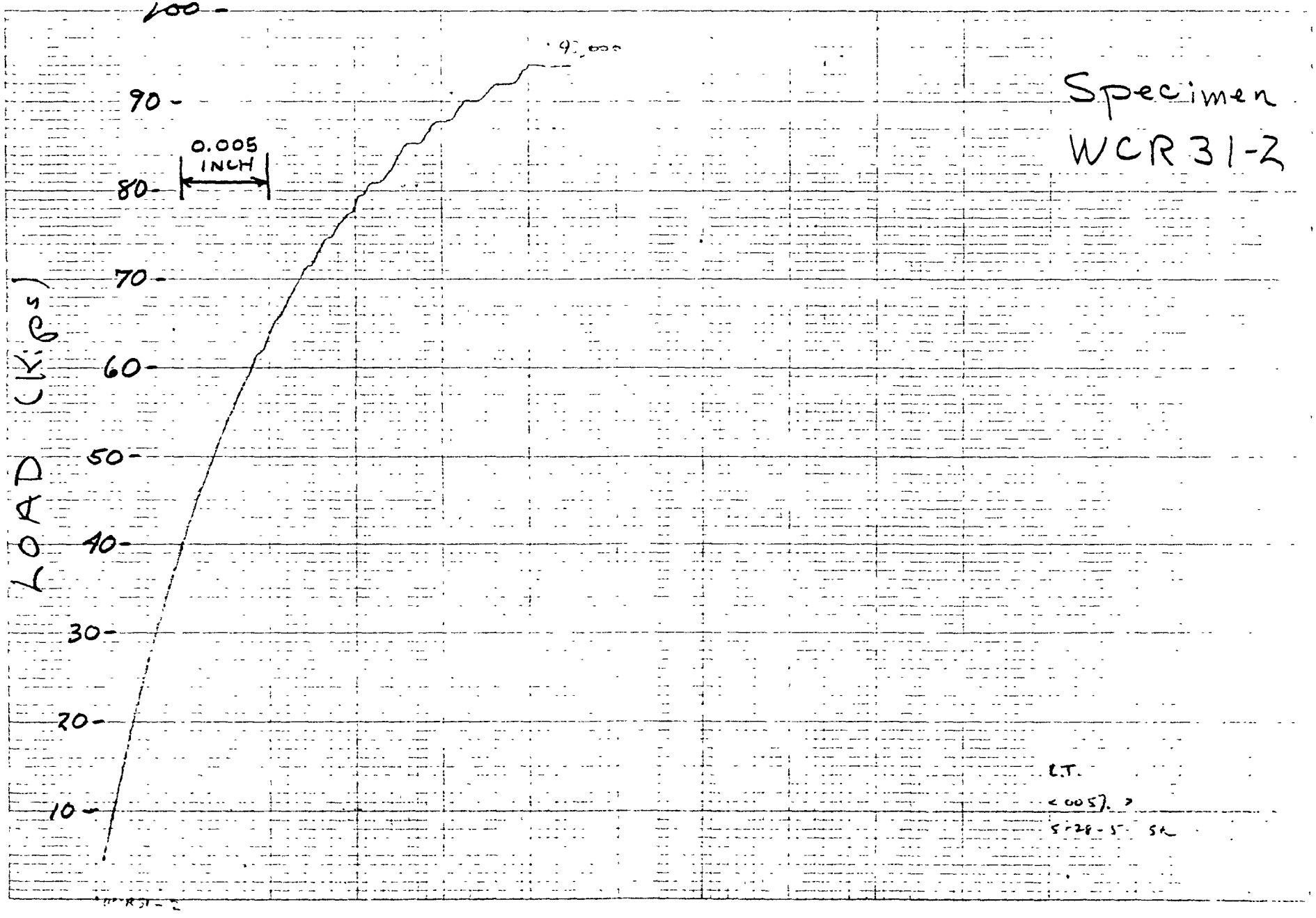
47 0703

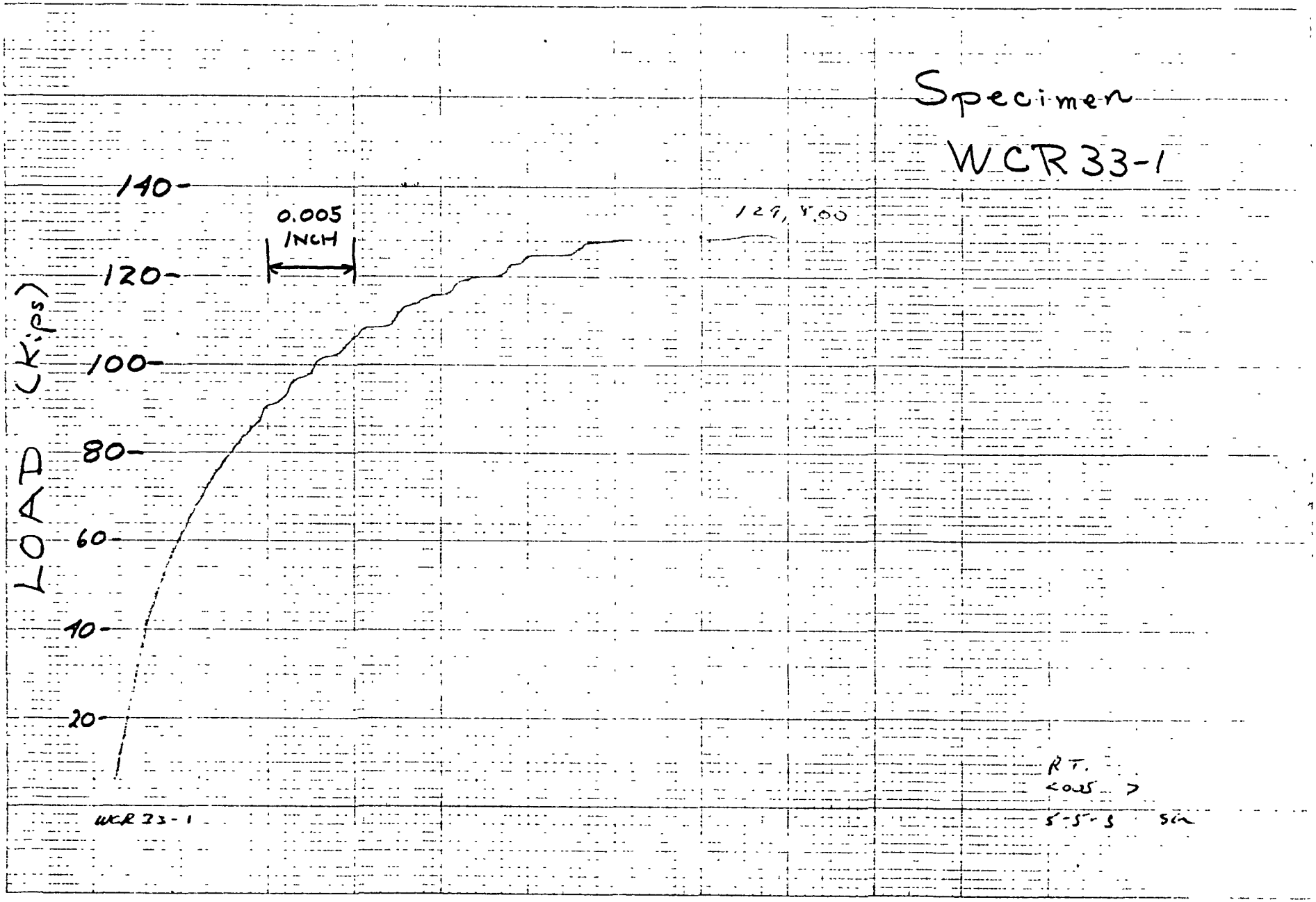

ULT 82,100 LBS.
Specimen
WCN21-1
80
70
60
50
40
30
20
10
LOAD (KIPS)
0.005
INCH
WCN 21-1
< 0.005"
R.T.
4-22-5

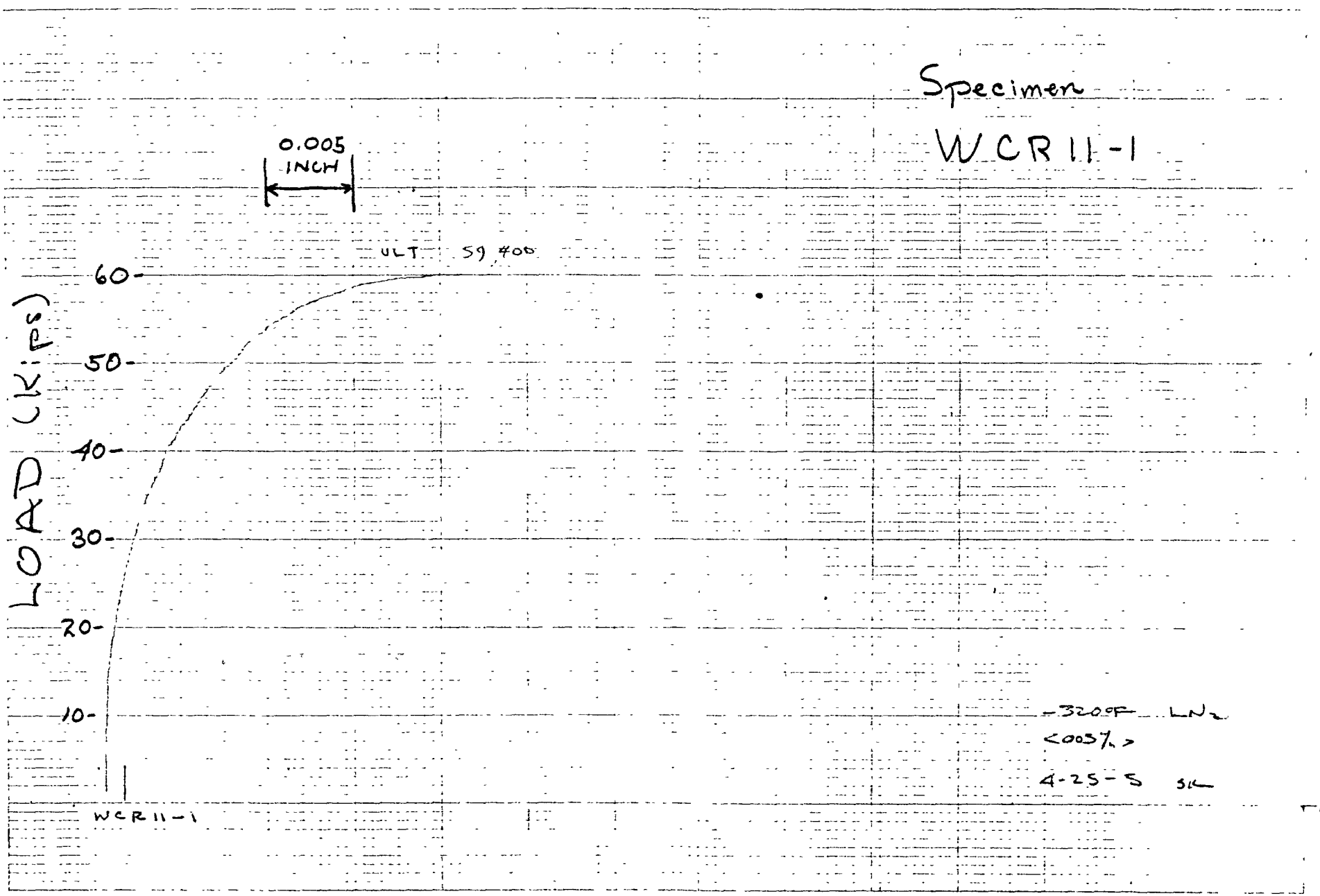

Specimen
WCR 21-2
LOAD (K-PS)
70
60
50
40
30
20
10
0.005
INCH
P.T.
WCR 21-2

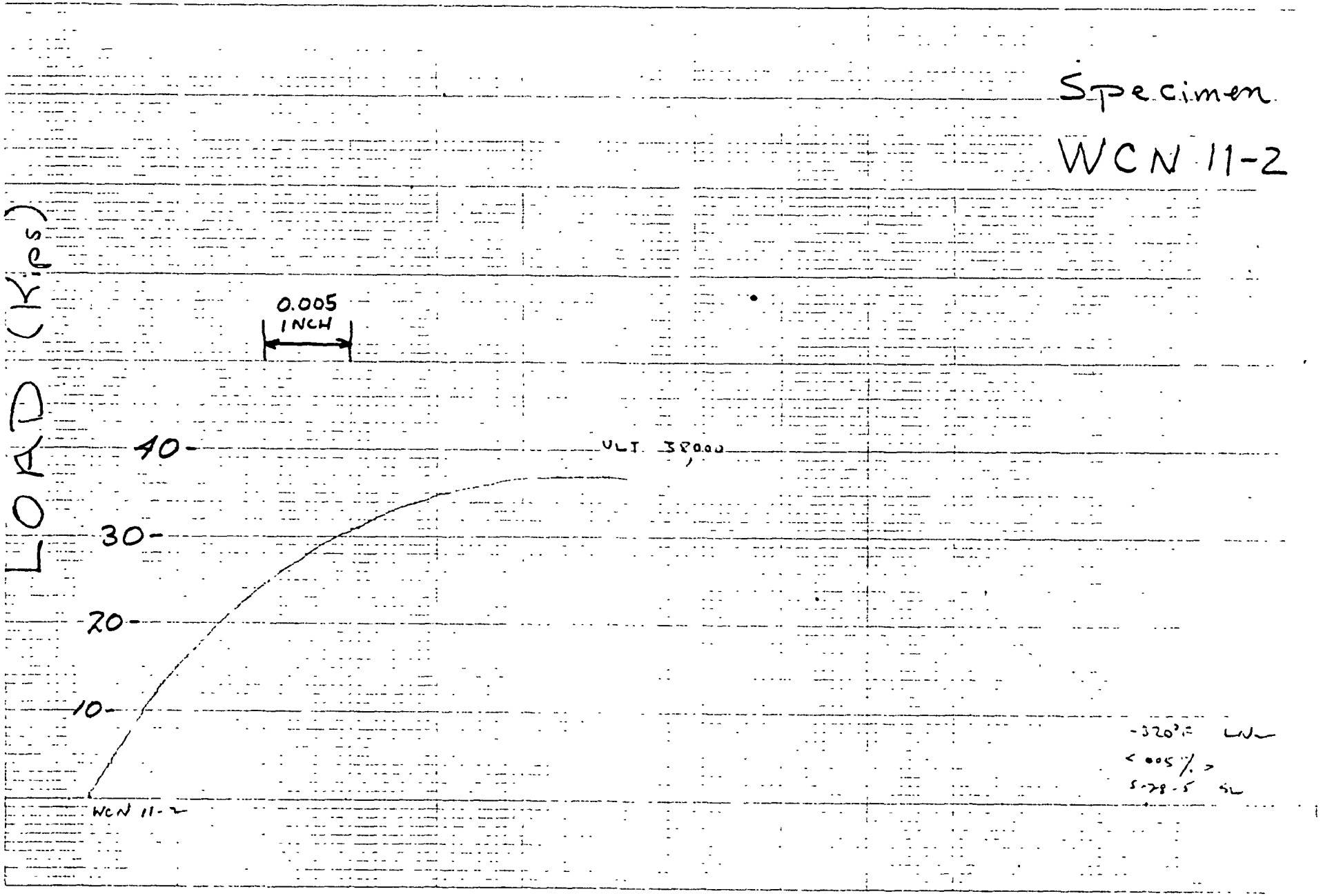

90
80
70
60
50
40
30
20
10
LOAD (KIPS)
85.00
0.005 INCH
Specimen
WCR23-1
RT
<003%>
4-29-5
WCR 23-1

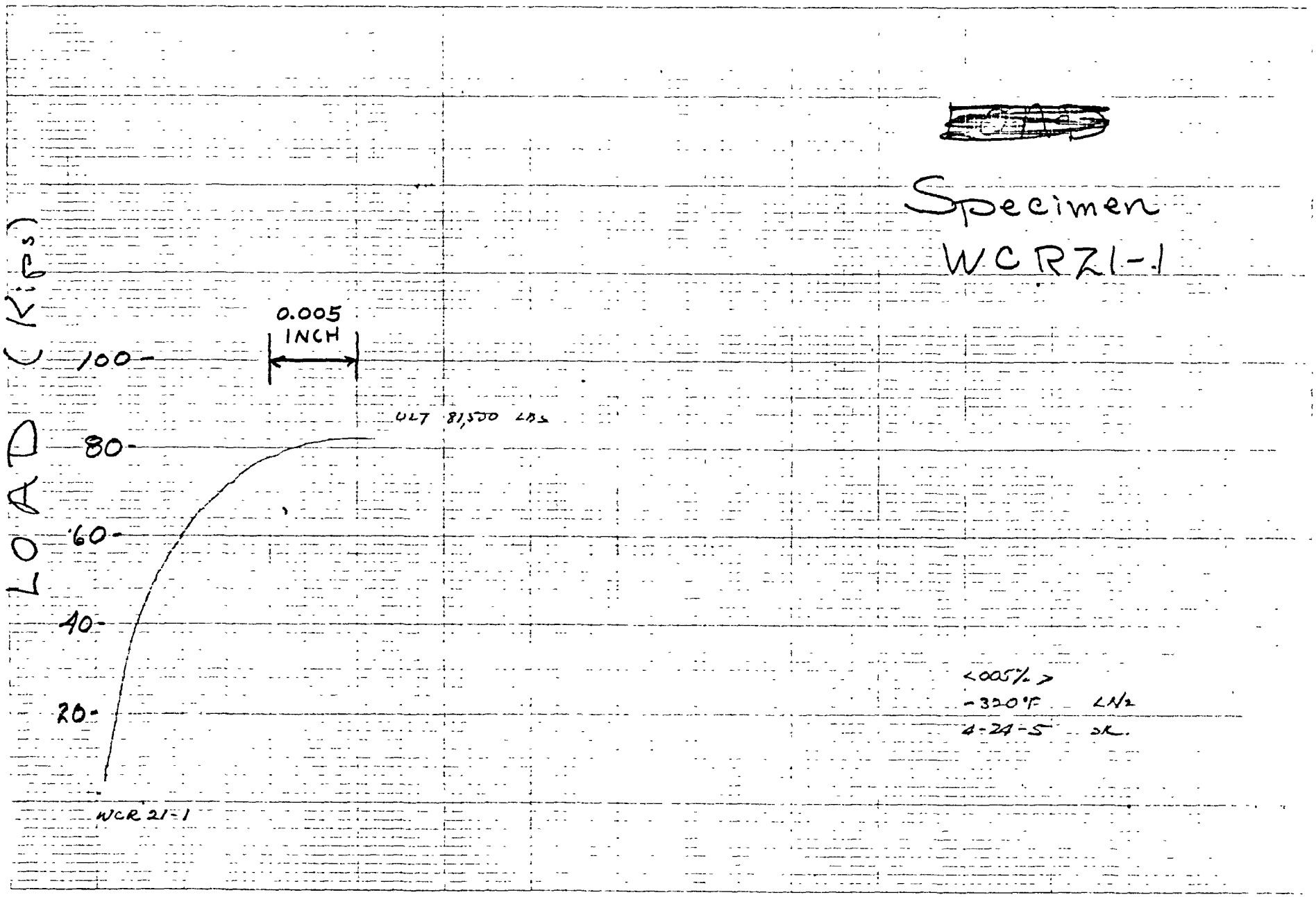

Specimen
WCR31-1
0.005
INCH
120
100
80
60
40
20
LOAD (KIPS)
WC231-1
R.T.
4-30-5

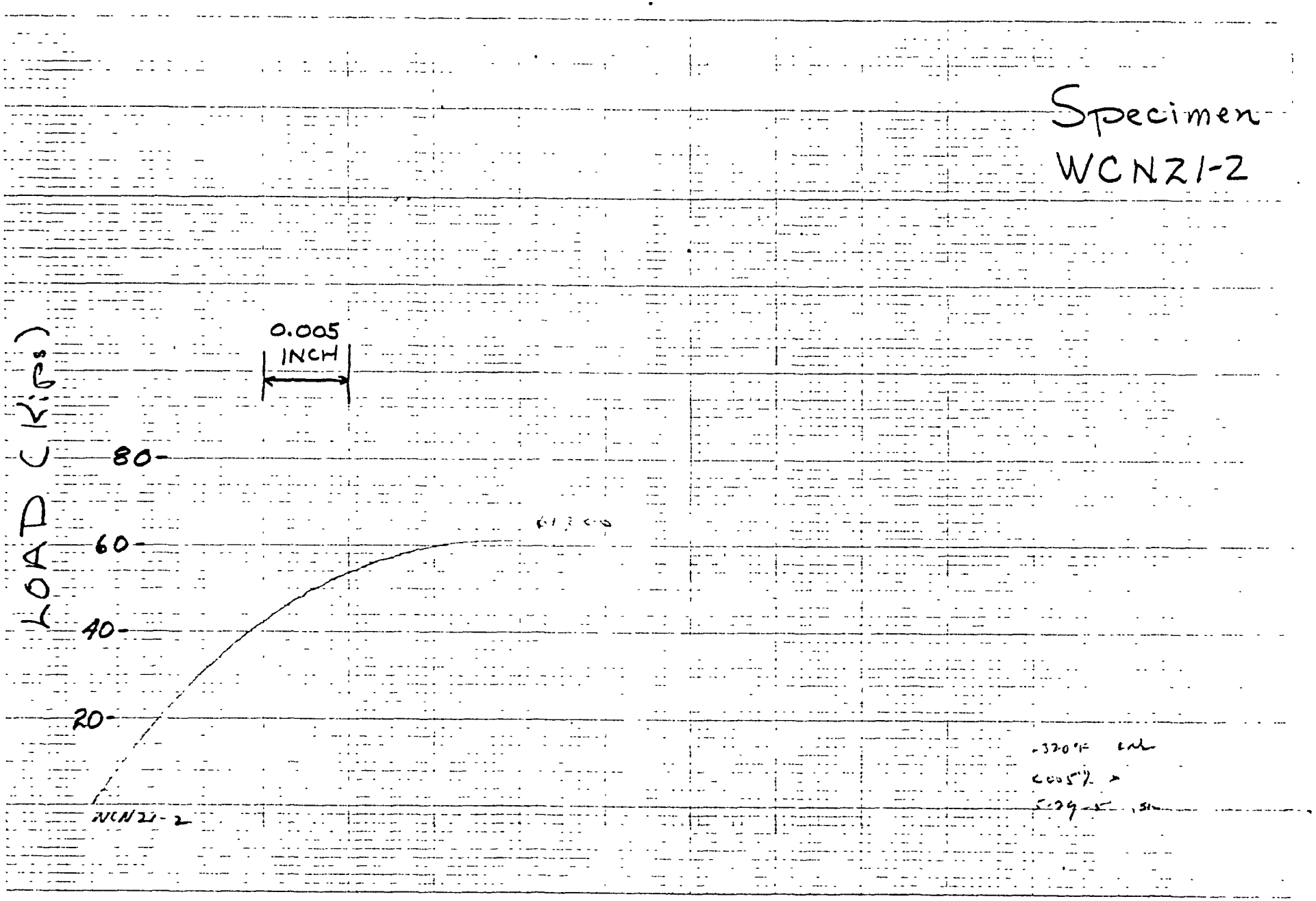

Specimen
WCR 31-2
0.005
INCH
LOAD (KIPS)
100
90
80
70
60
50
40
30
20
10
L.T.
< 0057. >
5-28-5-

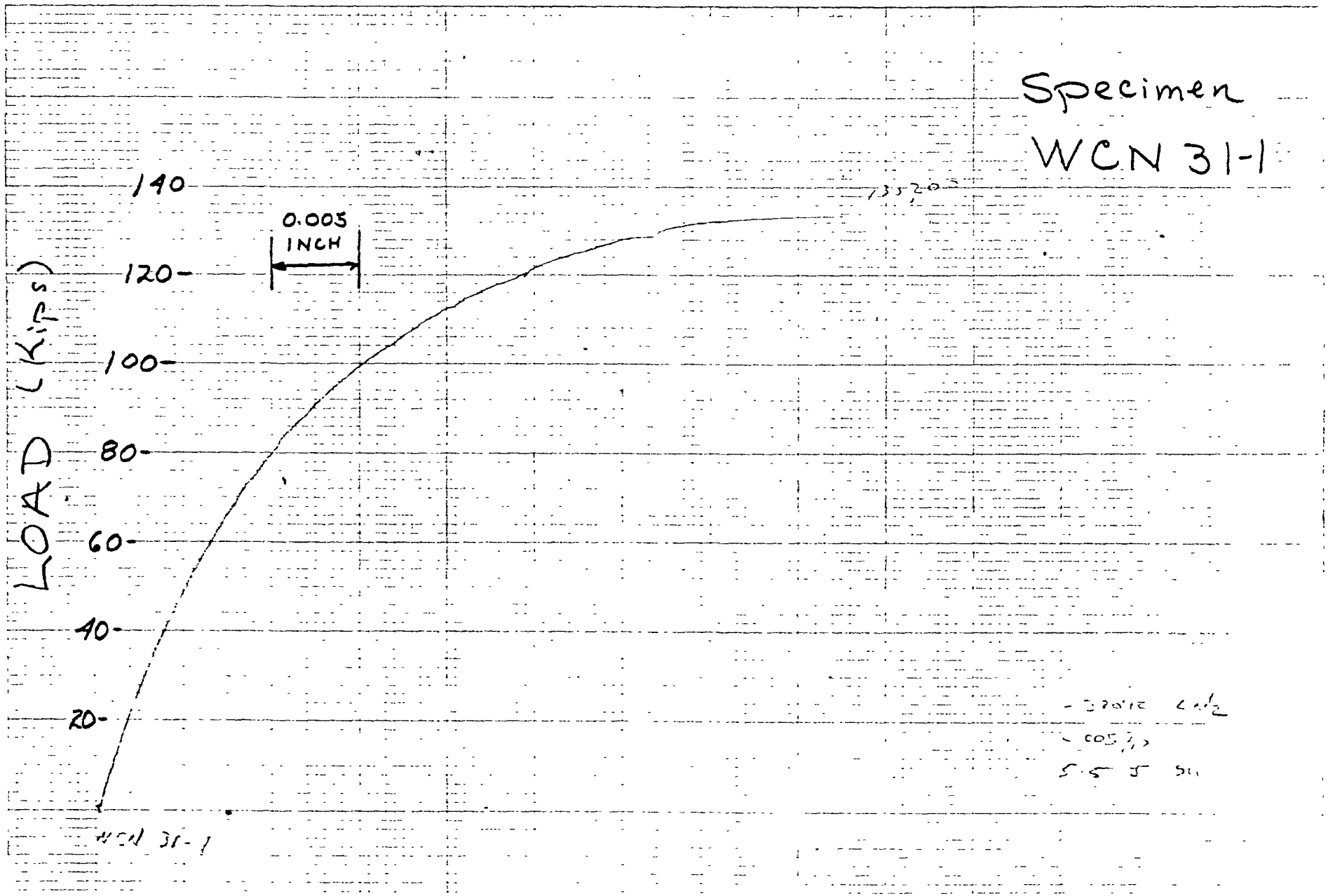

Specimen
WCR 33-1
140
120
100
80
60
40
20
LOAD (K.ips)
0.005 INCH
129, 7.00
WCR 33-1
RT.
5-5-5 Sec

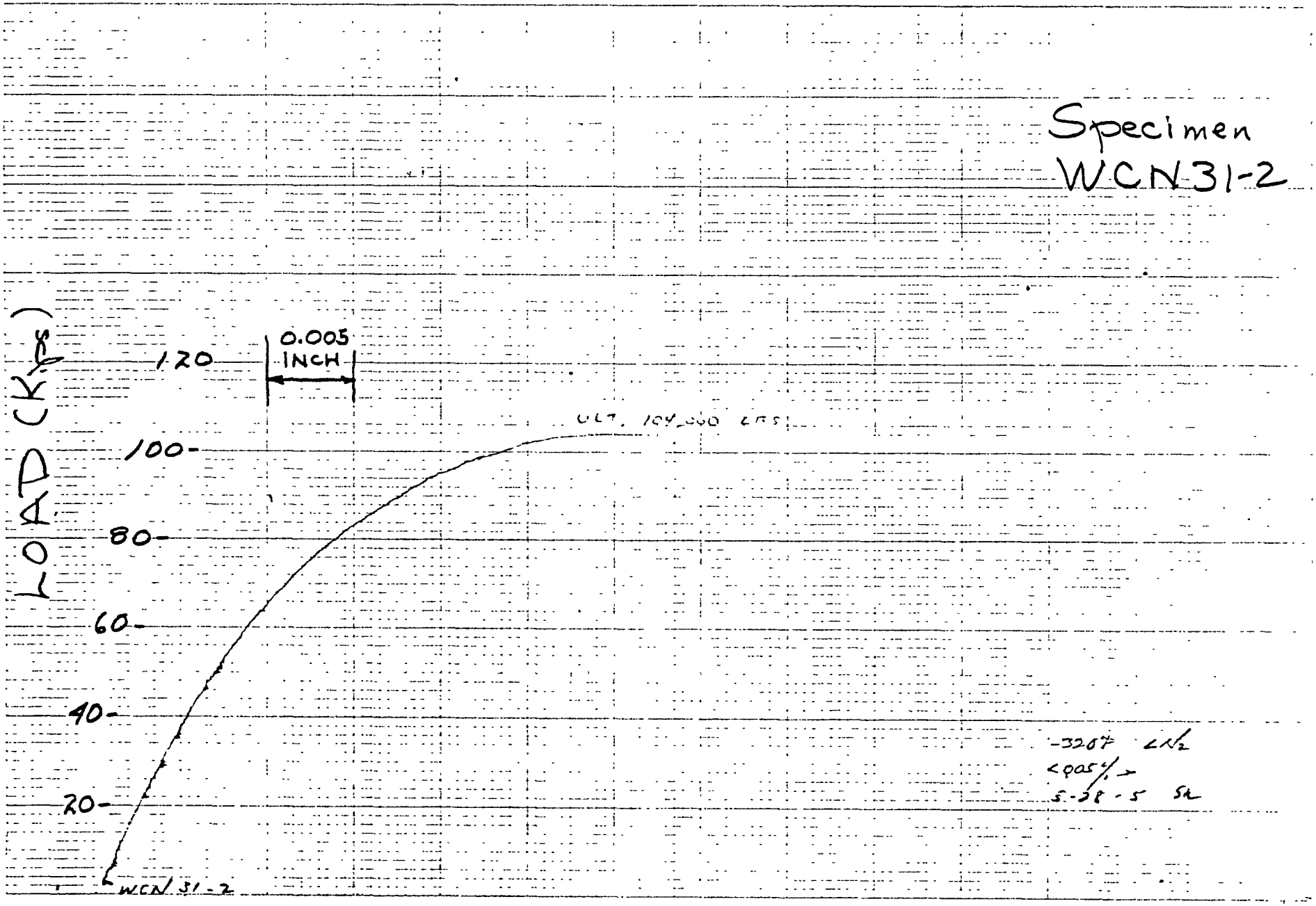

Specimen
WCR11-1
0.005
INCH
ULT 59 #00
60
50
40
30
20
10
LOAD (KIPS)
WCR11-1
-320°F LN2
<005%>
4-25-5

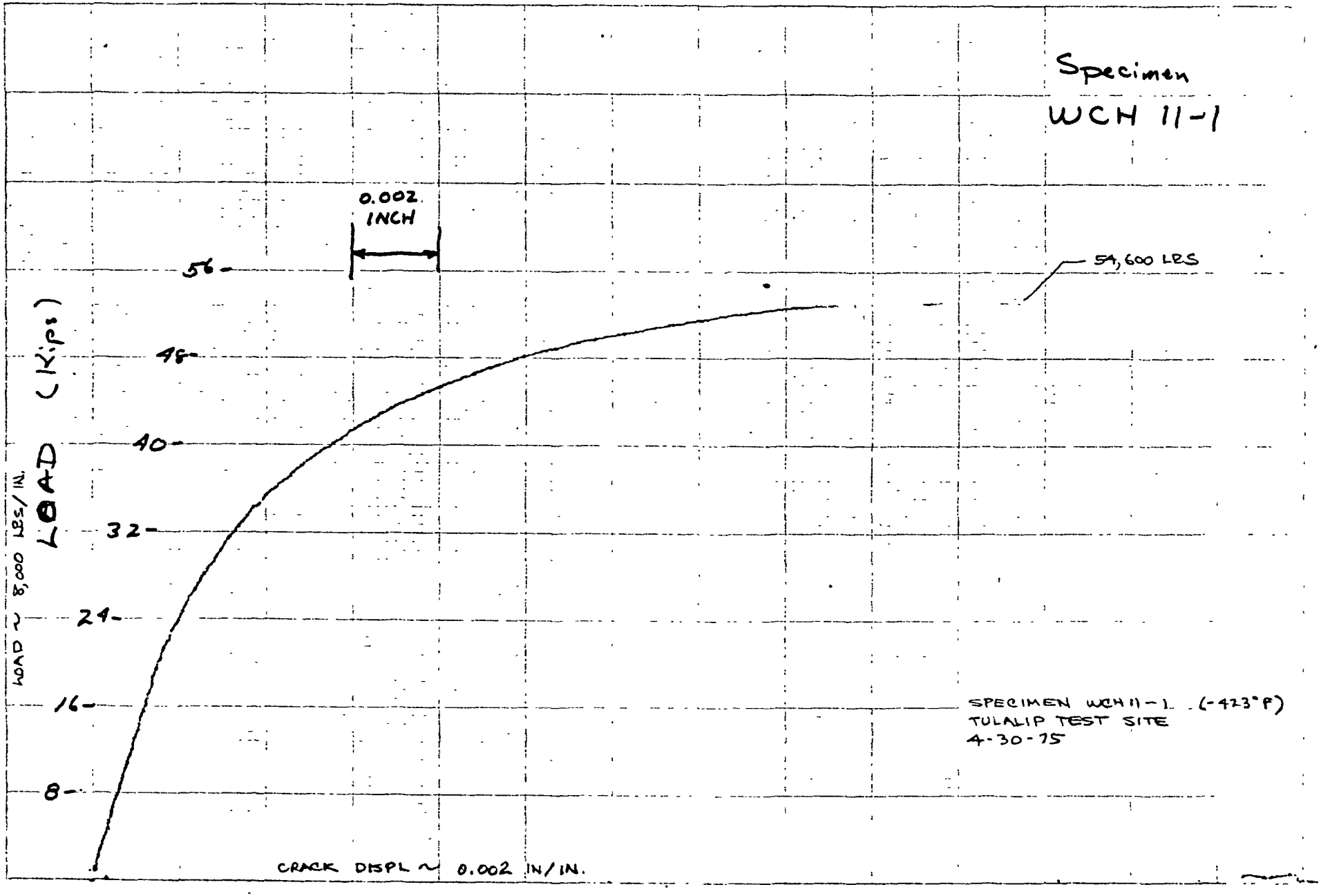

Specimen
WCN 11-2
LOAD (Kips)
0.005
INCH
40
30
20
10
ULT. 38,000
WCN 11-2
-320°F LN
< .005 % >
5-28-5

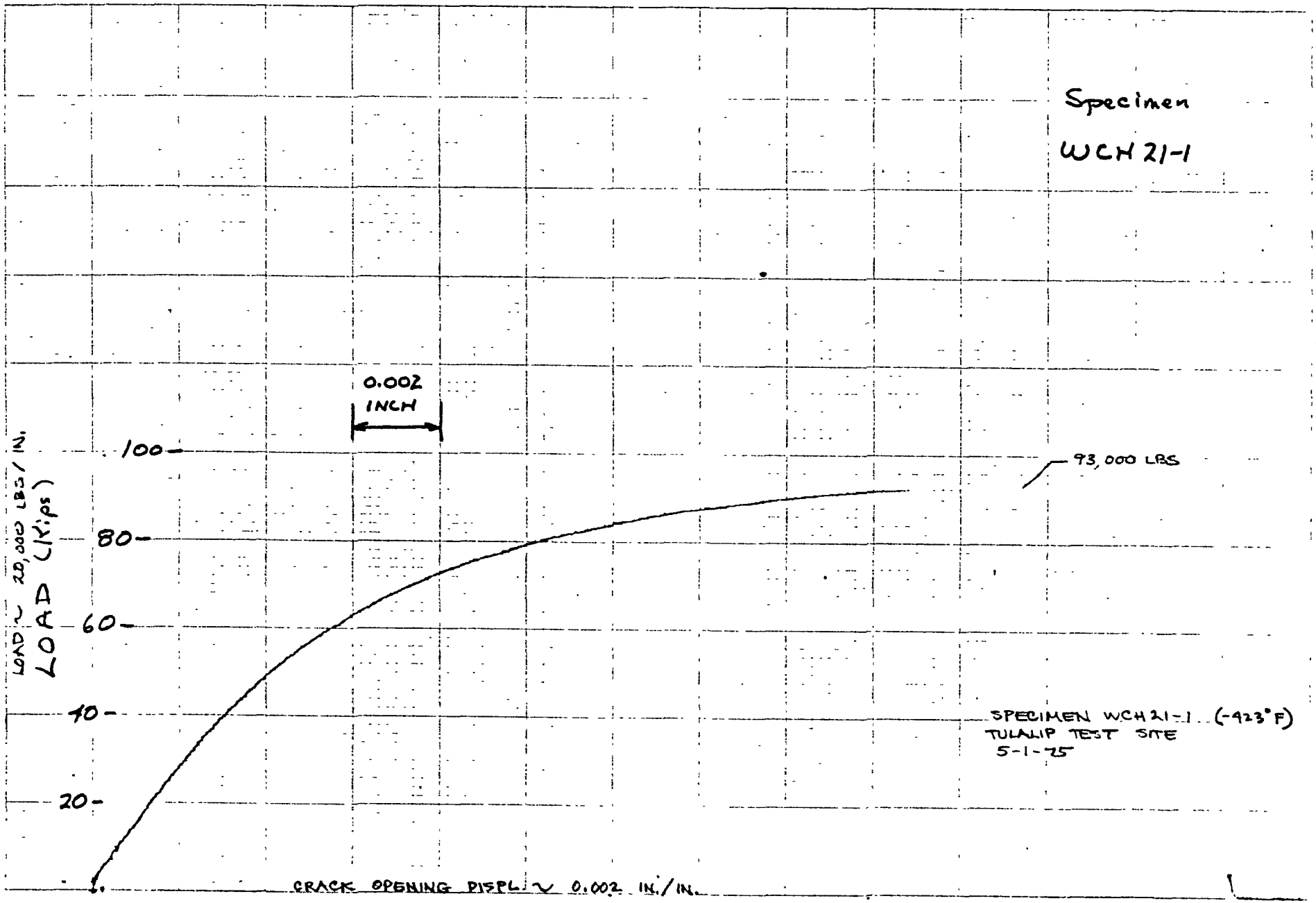

Specimen
WCR21-1
0.005
INCH
LOAD (Kips)
100
80
60
40
20
ULT 81,500 LBS
WCR 21-1
<.005%>
-320°F LN2
4-24-5 SR.

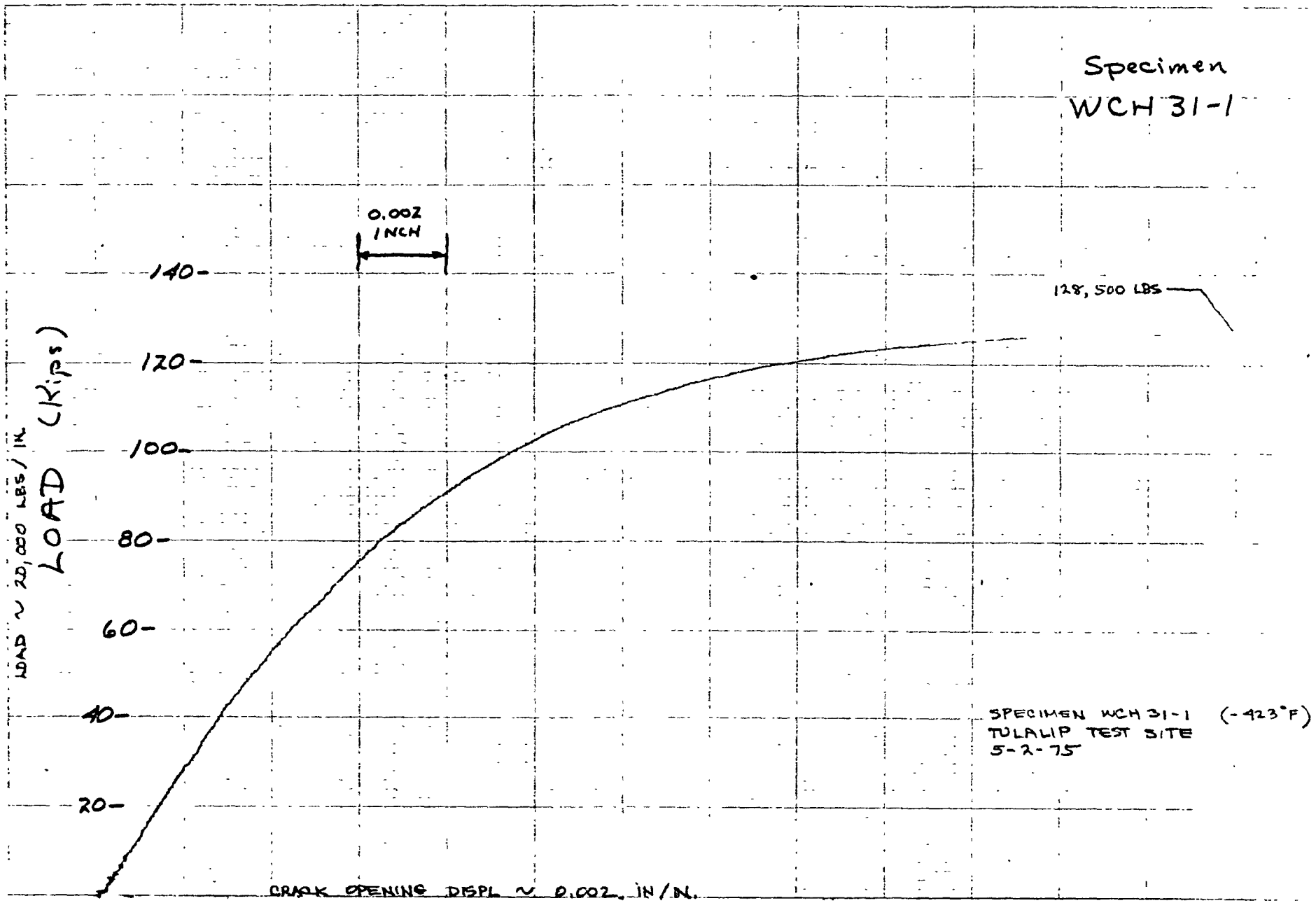

Specimen
WCNZ1-2
0.005
INCH
LOAD (Kips)
80
60
40
20
WCNZ1-2
-320°F
<0.05%


Specimen
WCN 31-1
LOAD (KIPS)
140
120
100
80
60
40
20
0.005
INCH
WCN 31-1


Specimen
WCN31-2
LOAD (KIPS)
120
100
80
60
40
20
0.005
INCH
ULT. 104,000 LBS
WCN 31-2
-320F 2½
<905%>
5-38-5 SL


Specimen
WCH 11-1
0.002
INCH
54,600 LBS
56
48
40
32
24
16
8
LOAD (Kips)
LOAD ~ 8,000 LBS/IN.
CRACK DISPL ~ 0.002 IN/IN.
SPECIMEN WCH 11-1 (-423°F)
TULALIP TEST SITE
4-30-75


Specimen
WCH 21-1
0.002
INCH
100
80
60
40
20
LOAD ~ 20,000 LBS / IN.
LOAD (Kips)
93,000 LBS
SPECIMEN WCH 21-1 (-423°F)
TULALIP TEST SITE
5-1-75
CRACK OPENING DISPL. ~ 0.002 IN./IN.


Specimen
WCH 31-1
0.002
INCH
140
120
100
80
60
40
20
LOAD (KIPS)
LOAD ~ 20,000 LBS/IN.
128, 500 LBS
SPECIMEN WCH 31-1 (-423°F)
TULALIP TEST SITE
5-2-75
CRACK OPENING DISPL ~ 0.002 IN/IN.

APPENDIX II - Surface Flawed Specimen Crack Opening Displacement Records

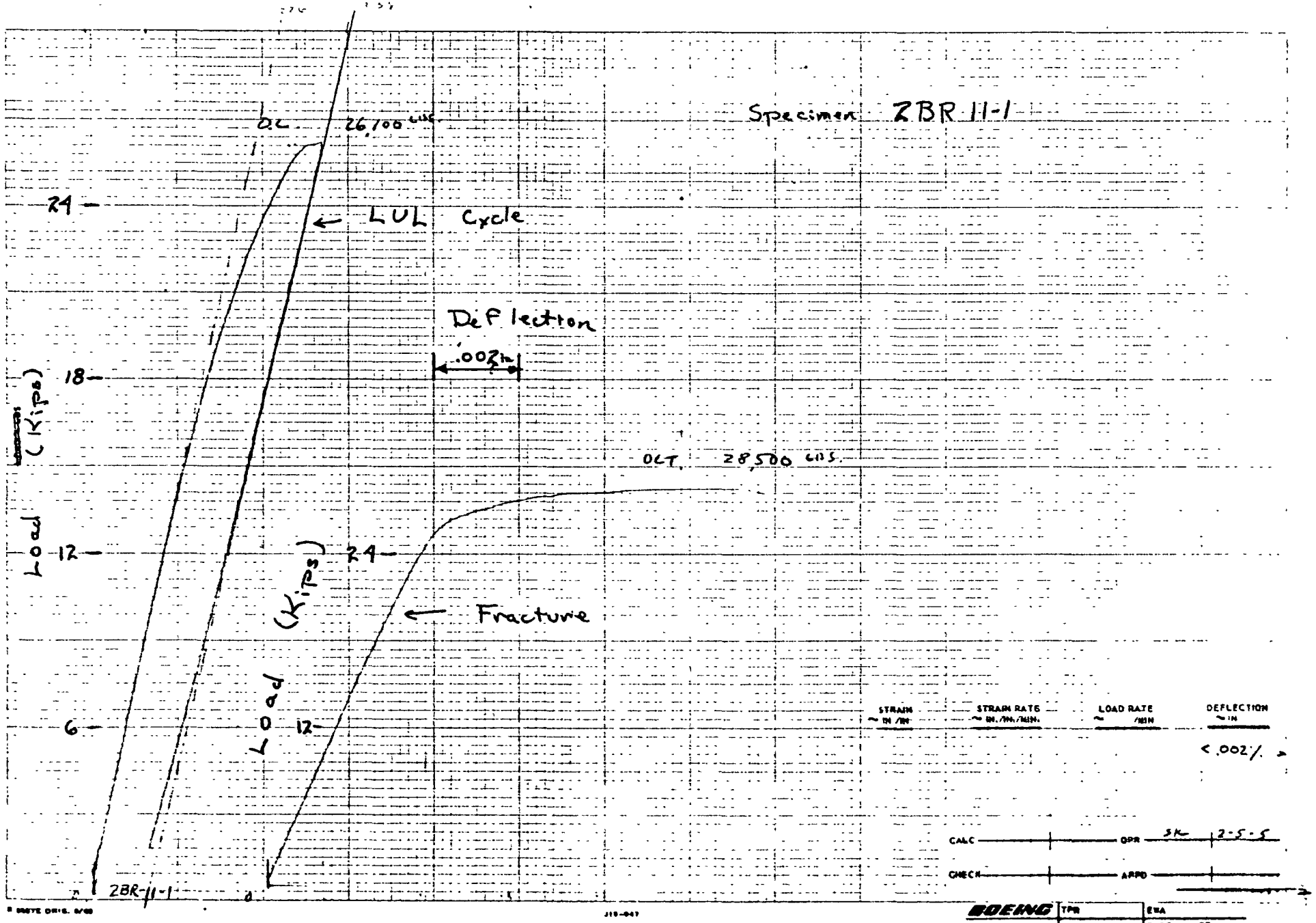
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Crack Opening Displacement Records for the Specimen Presented in Table 14 of Vol. I. CR-135036	59 - 65
Crack Opening Displacement Records for the Specimen Presented in Table 15 of Vol. I. CR-135036	66 - 71
Crack Opening Displacement Records for the Specimen Presented in Table 16 of Vol. I. CR-135036	72 - 79
Crack Opening Displacement Records for the Specimen Presented in Table 17 of Vol. I. CR-135036	80 - 87
Crack Opening Displacement Records for the Specimen Presented in Table 18 of Vol. I. CR-135036	88 - 94
Crack Opening Displacement Records for the Specimen Presented in Table 19 of Vol. I. CR-135036	95 - 102
Crack Opening Displacement Records for the Specimen Presented in Table 20 of Vol. I. CR-135036	103 - 110
Crack Opening Displacement Records for the Specimen Presented in Table 21 of Vol. I. CR-135036	111 - 117
Crack Opening Displacement Records for the Specimen Presented in Table 22 of Vol. I. CR-135036	118 - 125
Crack Opening Displacement Records for the Specimen Presented in Table 23 of Vol. I. CR-135036	126 - 132
Crack Opening Displacement Records for the Specimen Presented in Table 24 of Vol. I. CR-135036	133 - 138
Crack Opening Displacement Records for the Specimen Presented in Table 25 of Vol. I. CR-135036	139 - 146

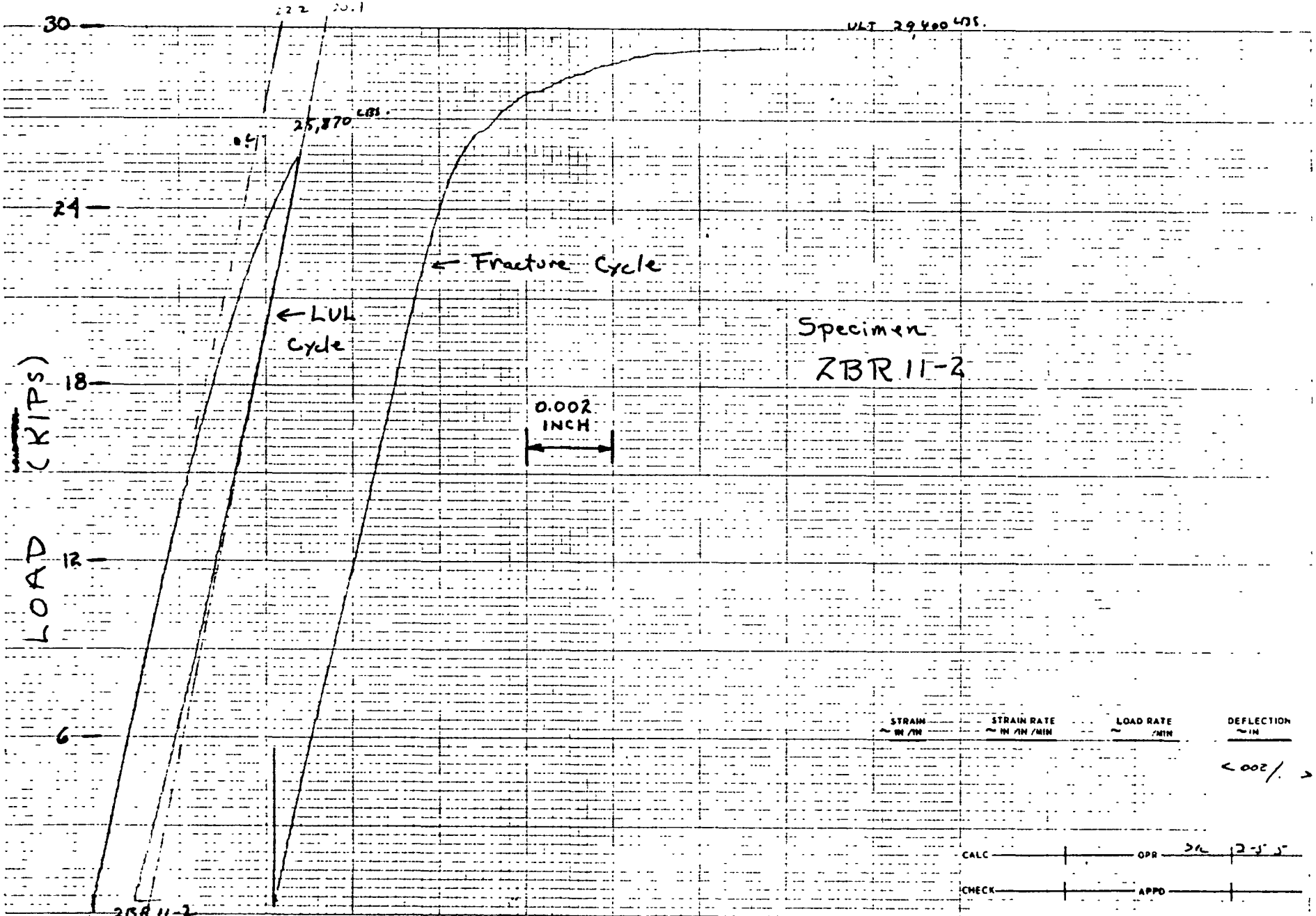
APPENDIX II - Surface Flawed Specimen Crack Opening Displacement Records

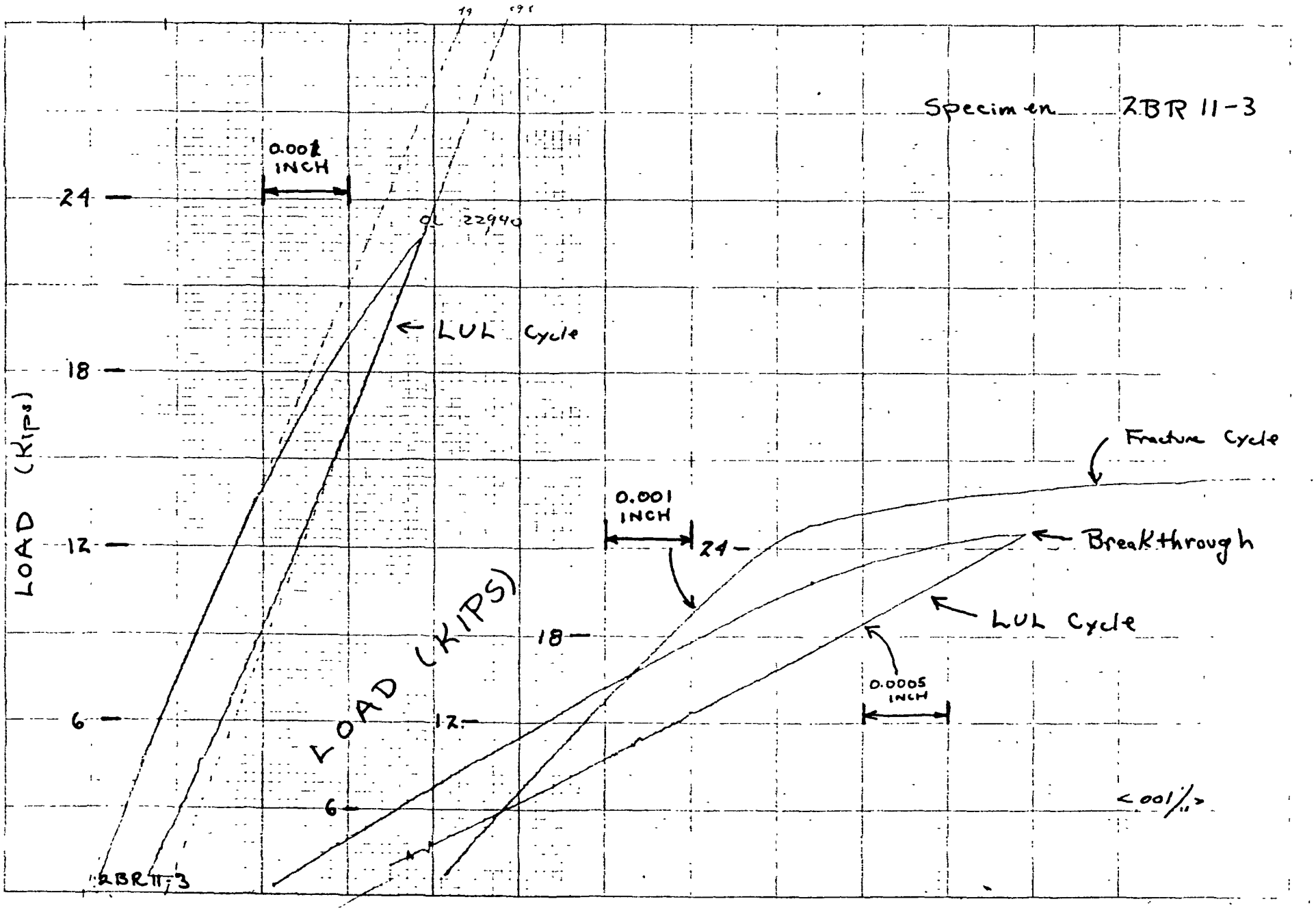
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Crack Opening Displacement Records for the Specimen Presented in Table 26 of Vol. I. CR-135036	147 - 151
Crack Opening Displacement Records for the Specimen Presented in Table 27 of Vol. I. CR-135036	152 - 159
Crack Opening Displacement Records for the Specimen Presented in Table 28 of Vol. I. CR-135036	160 - 165
Crack Opening Displacement Records for the Specimen Presented in Table 29 of Vol. I. CR-135036	166 - 172
Crack Opening Displacement Records for the Specimen Presented in Table 30 of Vol. I. CR-135036	173 - 178
Crack Opening Displacement Records for the Specimen Presented in Table 31 of Vol. I. CR-135036	179 - 181
Crack Opening Displacement Records for the Specimen Presented in Table 32 of Vol. I. CR-135036	182 - 189
Crack Opening Displacement Records for the Specimen Presented in Table 33 of Vol. I. CR-135036	190 - 194
Crack Opening Displacement Records for the Specimen Presented in Table 34 of Vol. I. CR-135036	195 - 200
Crack Opening Displacement Records for the Specimen Presented in Table 35 of Vol. I. CR-135036	201 - 203
Crack Opening Displacement Records for the Specimen Presented in Table 36 of Vol. I. CR-135036	204 - 209
Crack Opening Displacement Records for the Specimen Presented in Table 37 of Vol. I. CR-135036	210 - 216

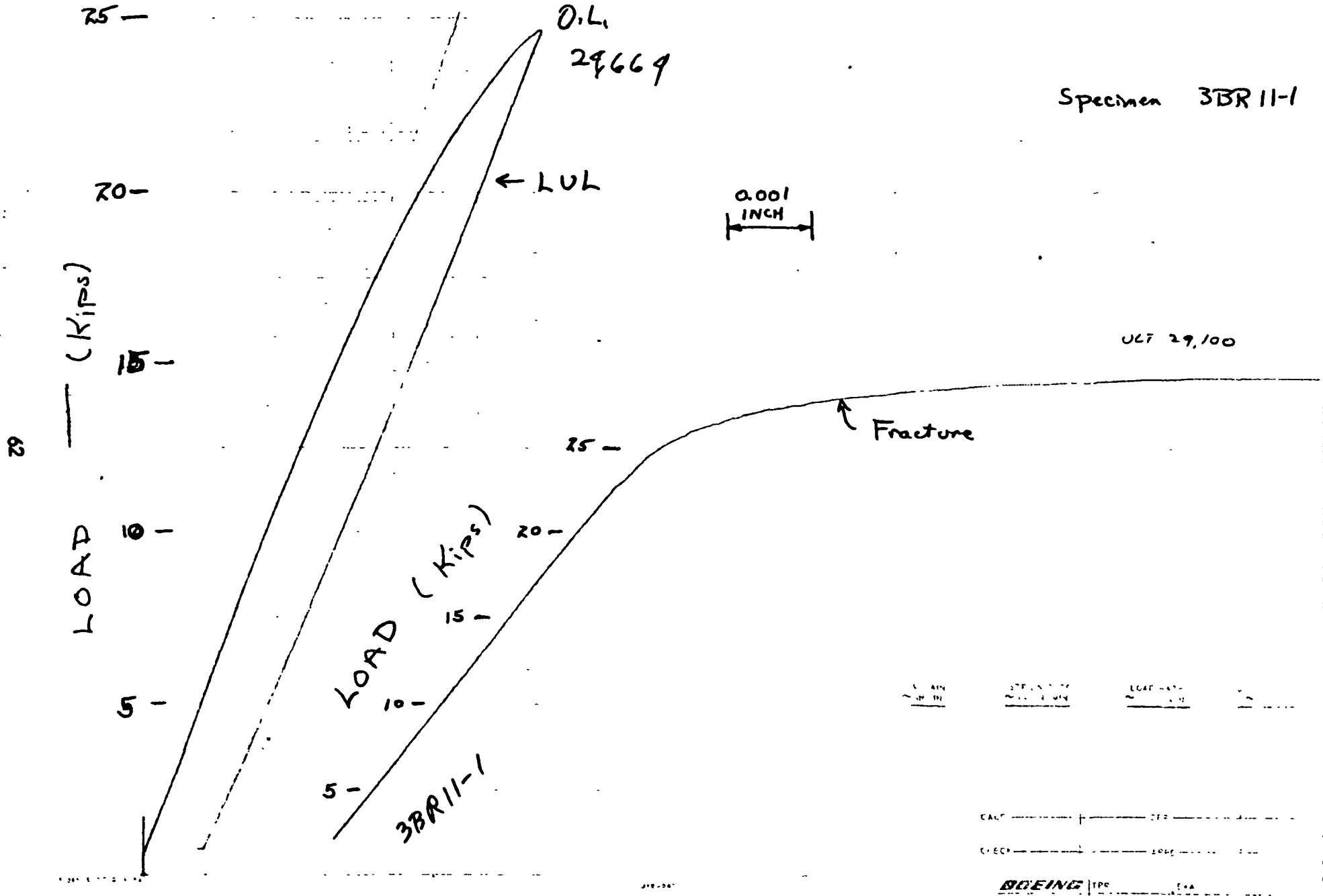
APPENDIX II - Surface Flawed Specimen Crack Opening Displacement Records

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Crack Opening Displacement Records for the Specimen Presented in Table 38 of Vol. I. CR-135036	217 - 224
Crack Opening Displacement Records for the Specimen Presented in Table 39 of Vol. I. CR-135036	225 - 229
Crack Opening Displacement Records for the Specimen Presented in Table 40 of Vol. I.	230 - 239
Crack Opening Displacement Records for the Specimen Presented in Table 41 of Vol. I. CR-135036	240 - 243
Crack Opening Displacement Records for the Specimen Presented in Table 42 of Vol. I. CR-135036	244 - 247
Crack Opening Displacement Records for the Specimen Presented in Table 43 of Vol. I. CR-135036	248 - 251


Specimen 2BR 11-1
OLC 26,700 cys.
← LUL Cycle
Deflection
.002in
OLT 28,500 cys.
← Fracture
Load (Kips)
24
18
12
6
0
12
24
2BR-11-1
STRAIN ~ IN /IN
STRAIN RATE ~ IN./IN./MIN.
LOAD RATE ~ /MIN
DEFLECTION ~ IN
< .002 /
CALC
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF

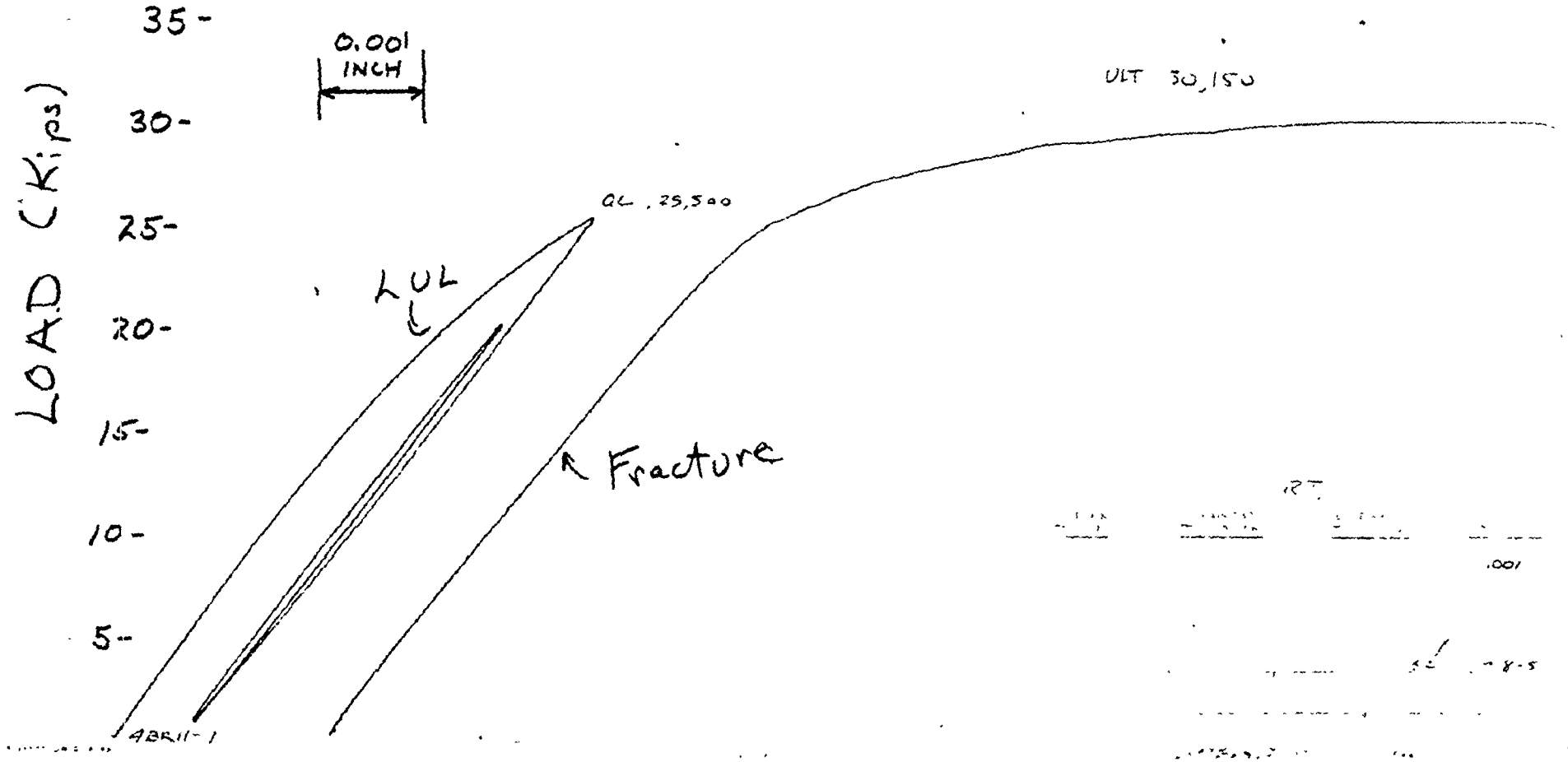

30
24
18
12
6
LOAD (KIPS)
ULT 29,400 LBS.
25,870 LBS.
← Fracture Cycle
← LUL Cycle
Specimen
ZBR11-2
0.002 INCH
ZBR11-2
STRAIN ~ IN /IN
STRAIN RATE ~ IN /IN /MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
< .002 >
CALC
OPR
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF


Specimen 2BR 11-3
0.002 INCH
24
18
12
6
LOAD (KIPS)
QL 22940
← LUL Cycle
2BR11-3
0.001 INCH
Fracture Cycle
Breakthrough
LUL Cycle
0.0005 INCH
<001>

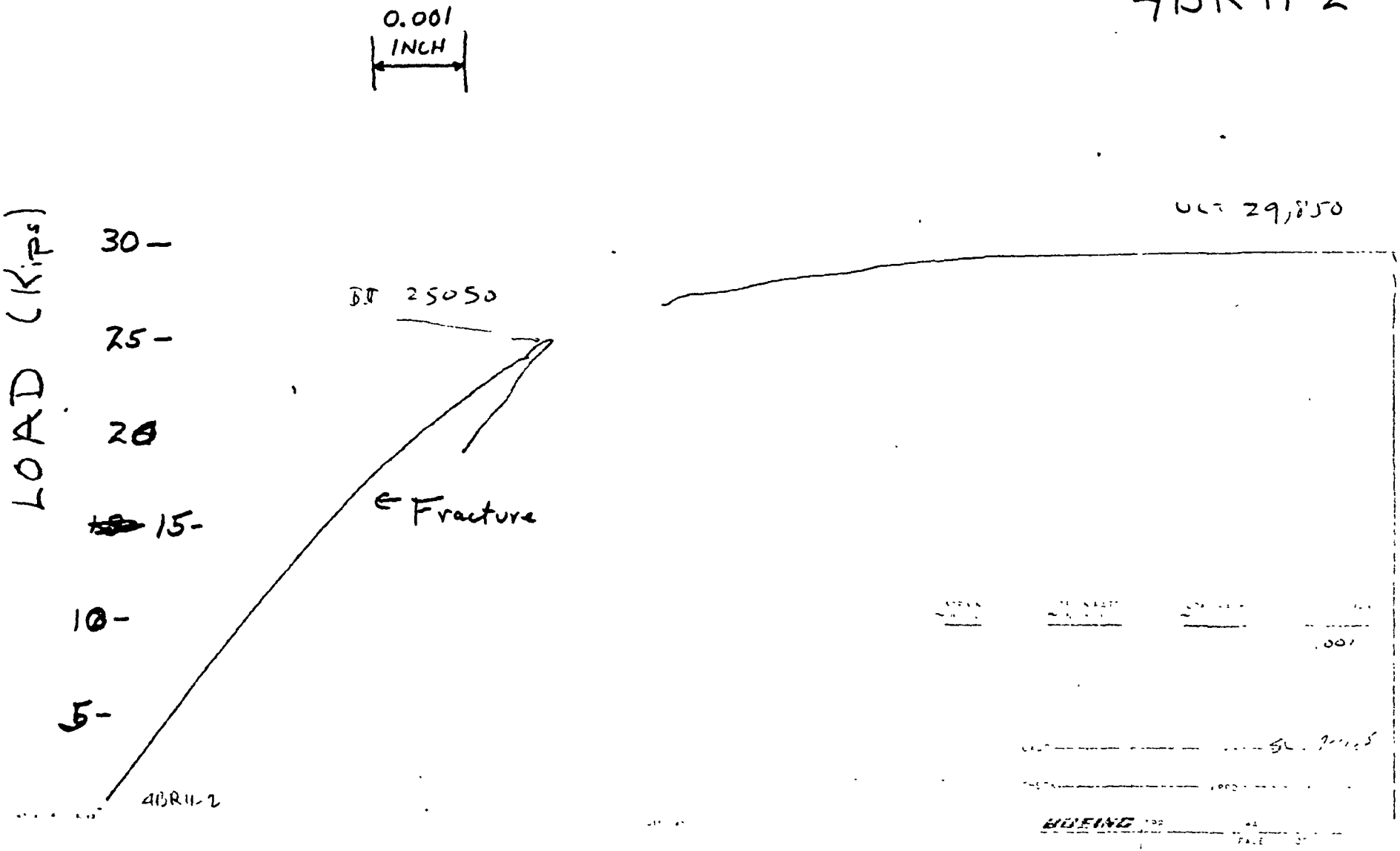

25
20
15
10
5
LOAD (Kips)
O.L.
29669
← LUL
0.001 INCH
ULT 29,100
Fracture
25
20
15
10
5
LOAD (Kips)
3BR11-1
Specimen 3BR11-1

Specimen

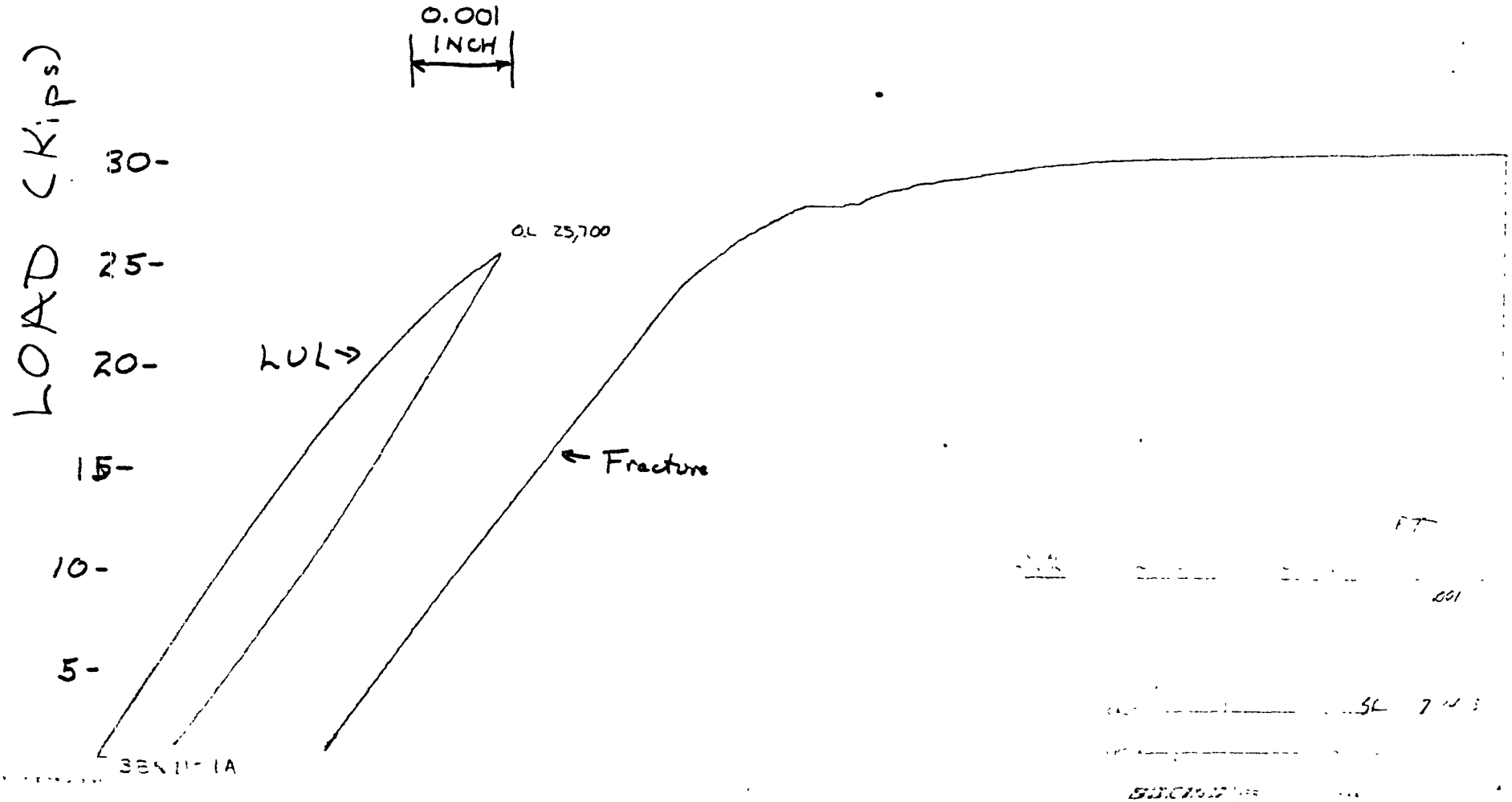
4BR 11-1

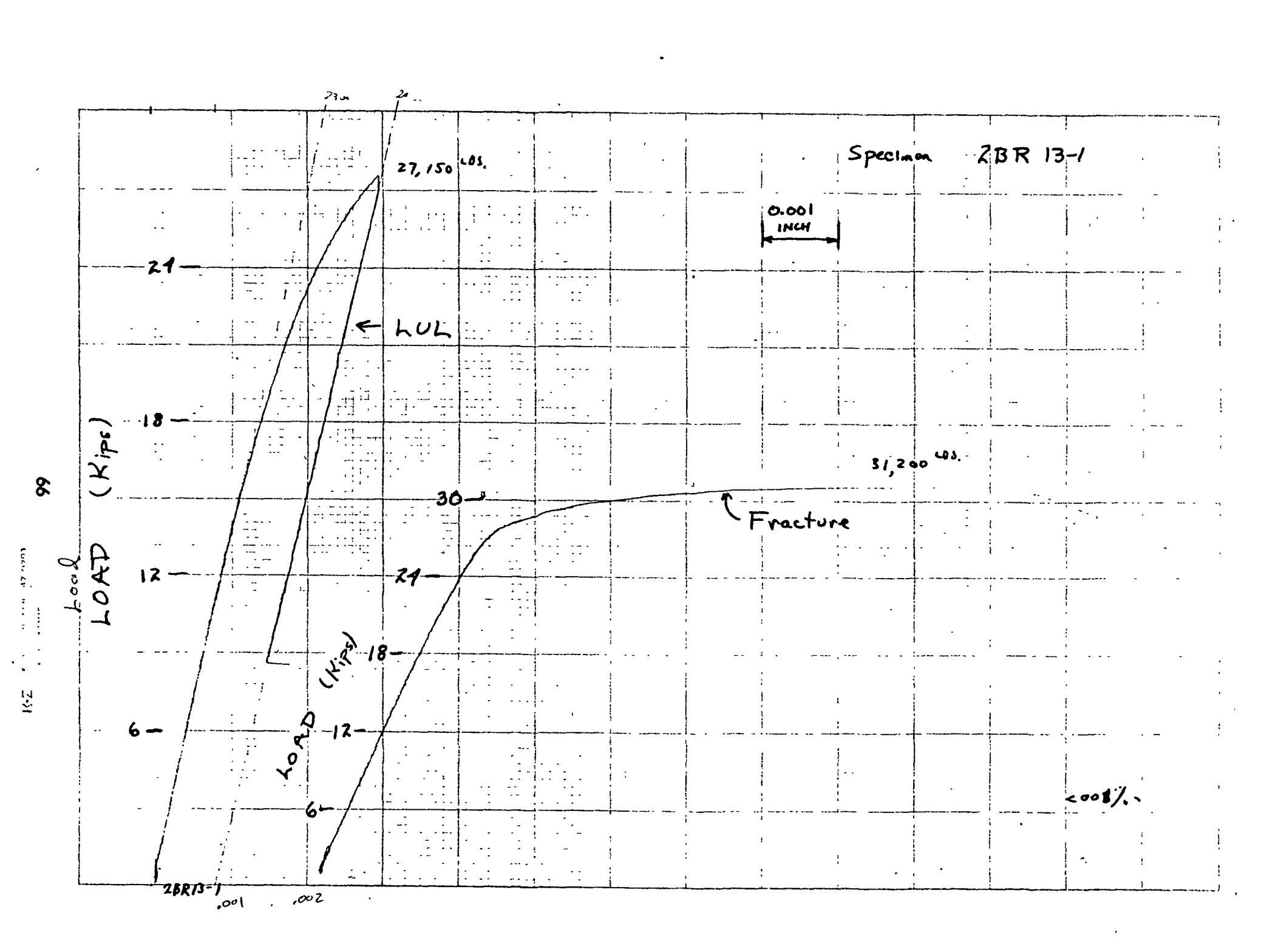


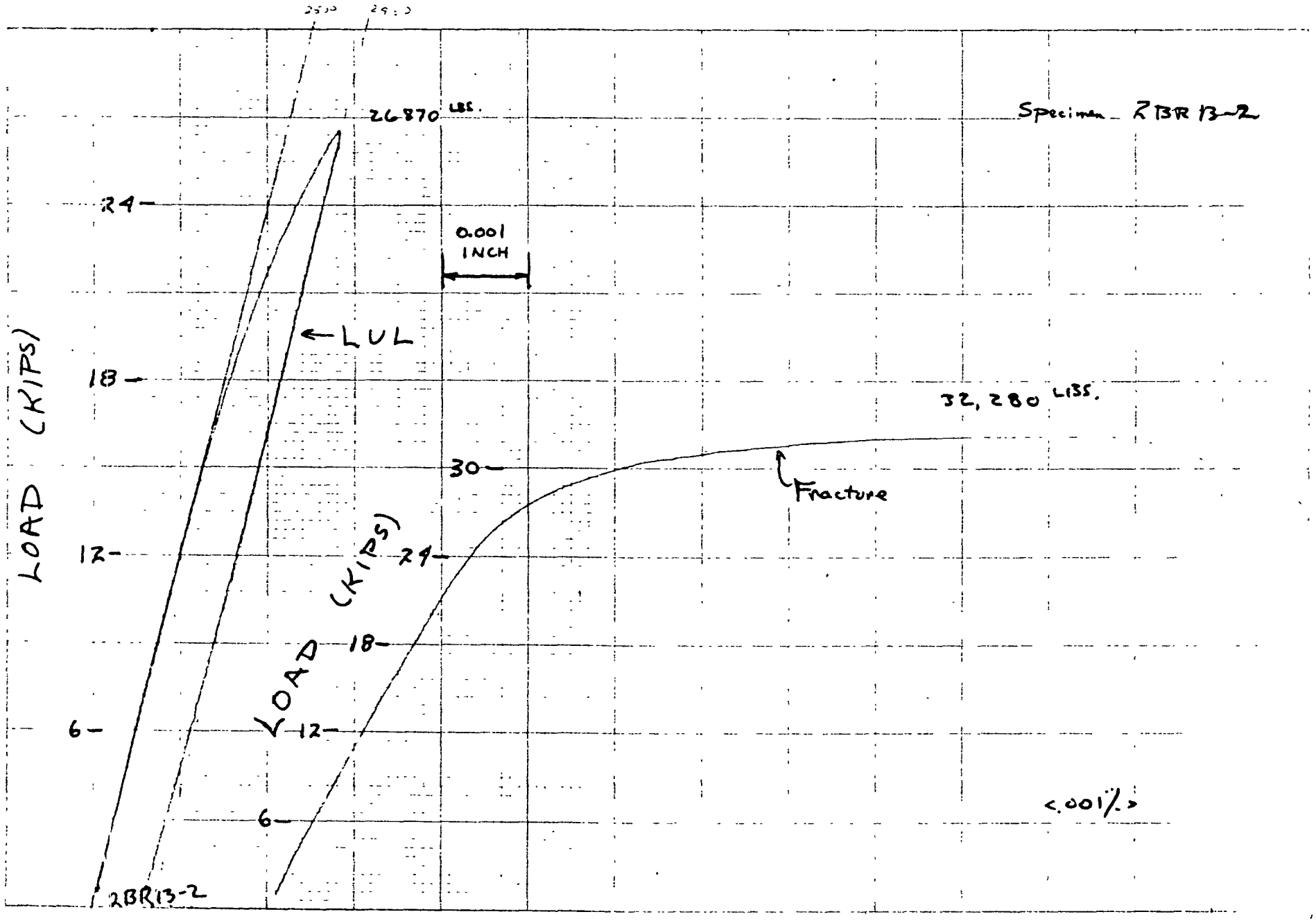
Specimen
4BR 11-2

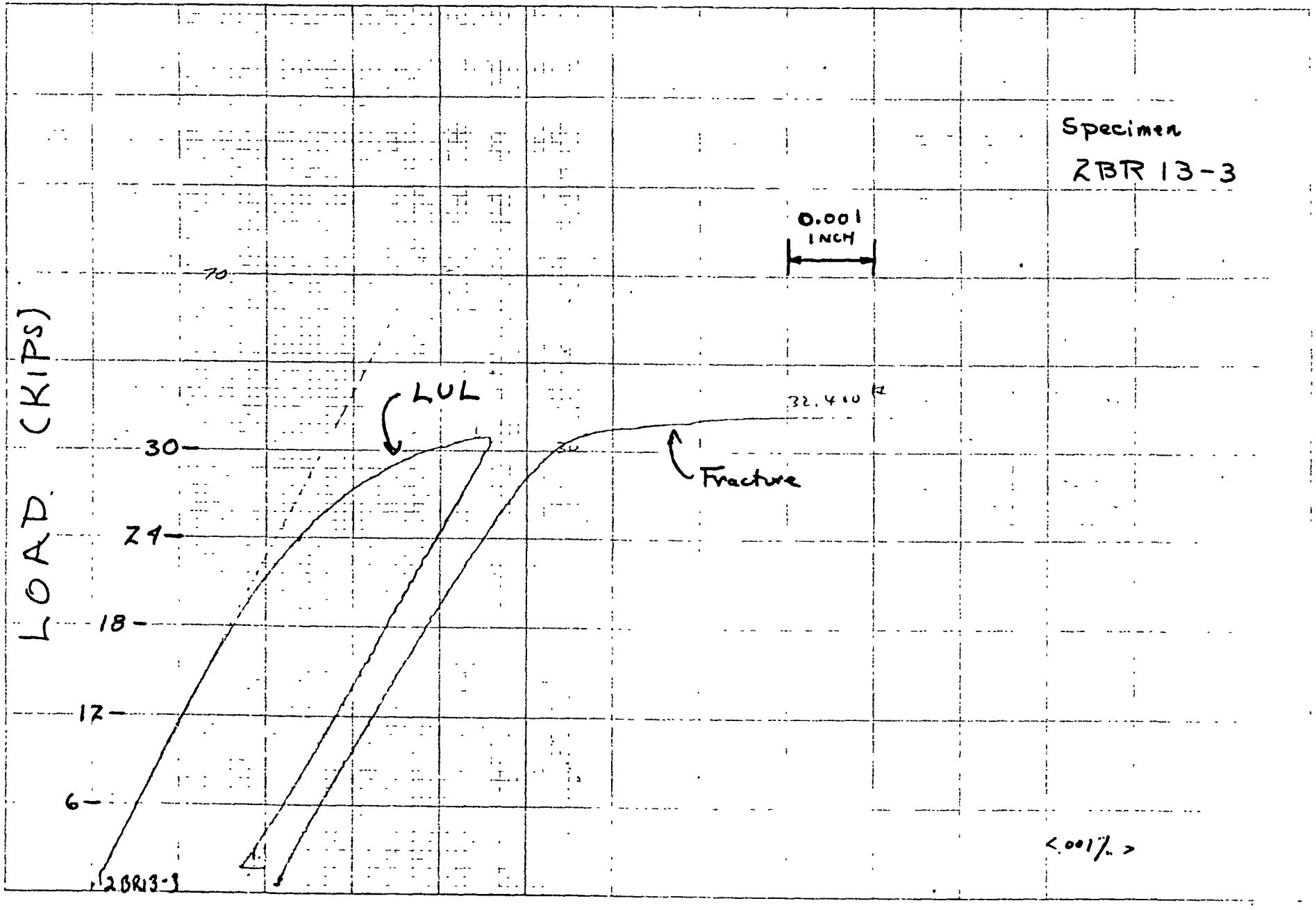


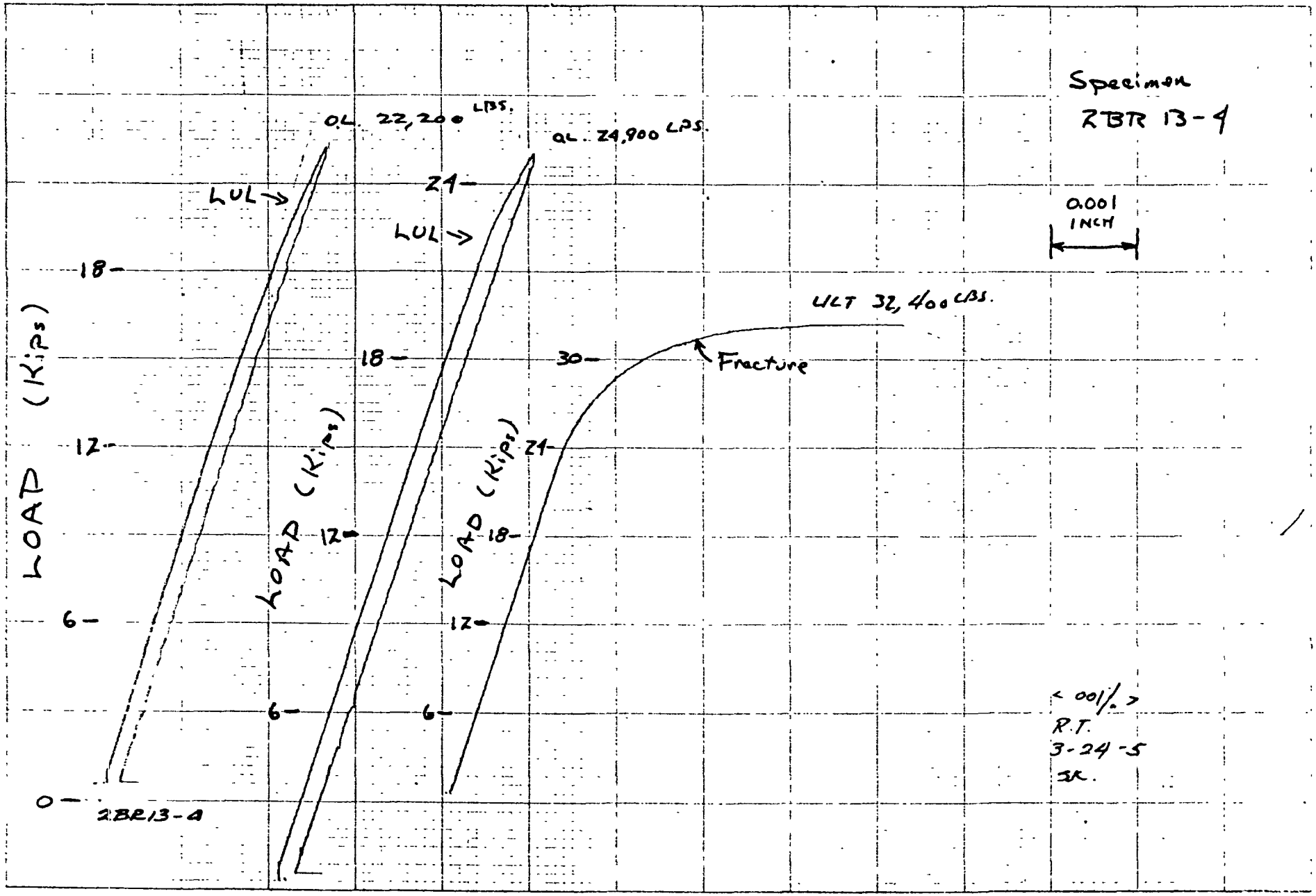
Specimen
3BN11-1A

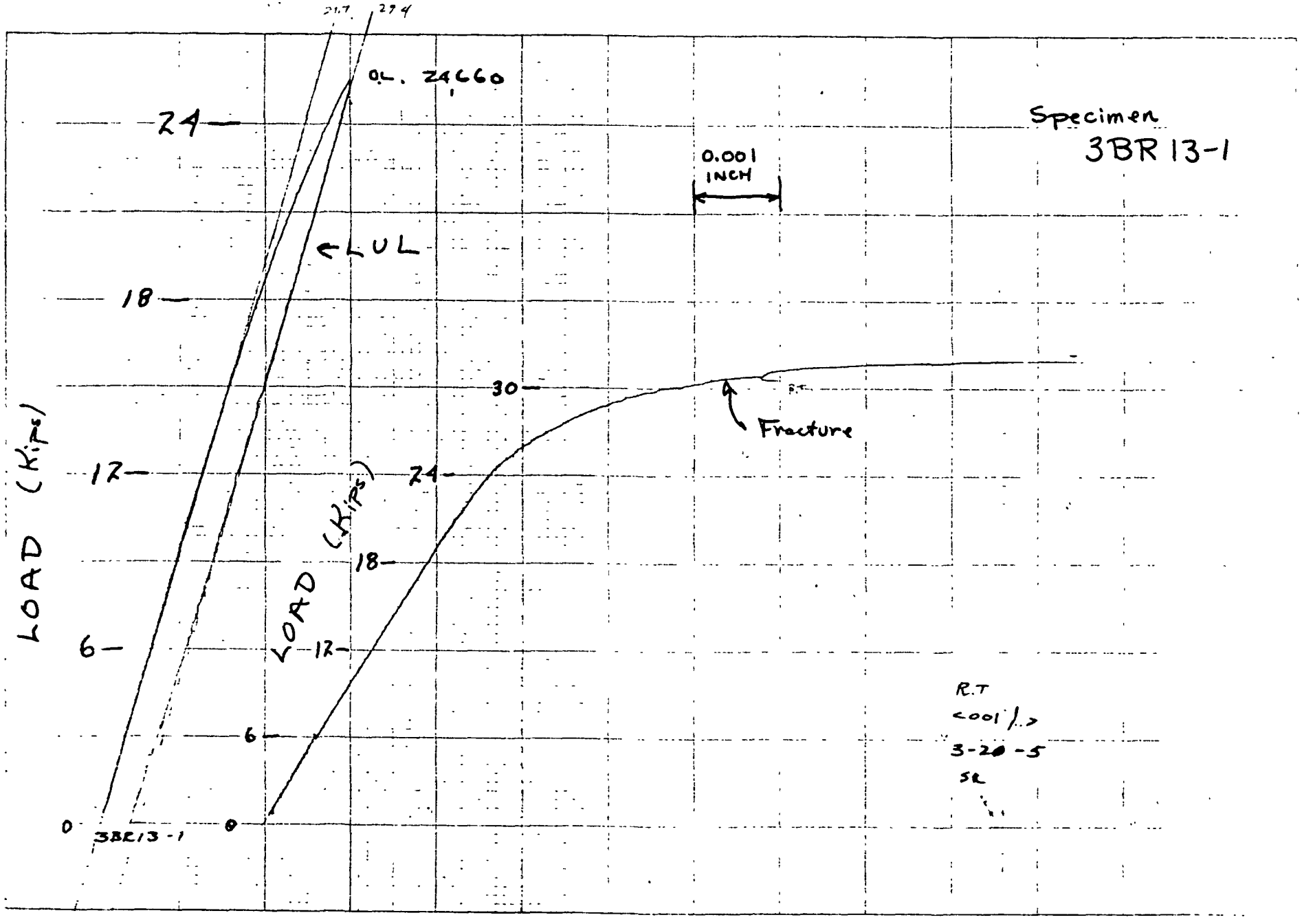


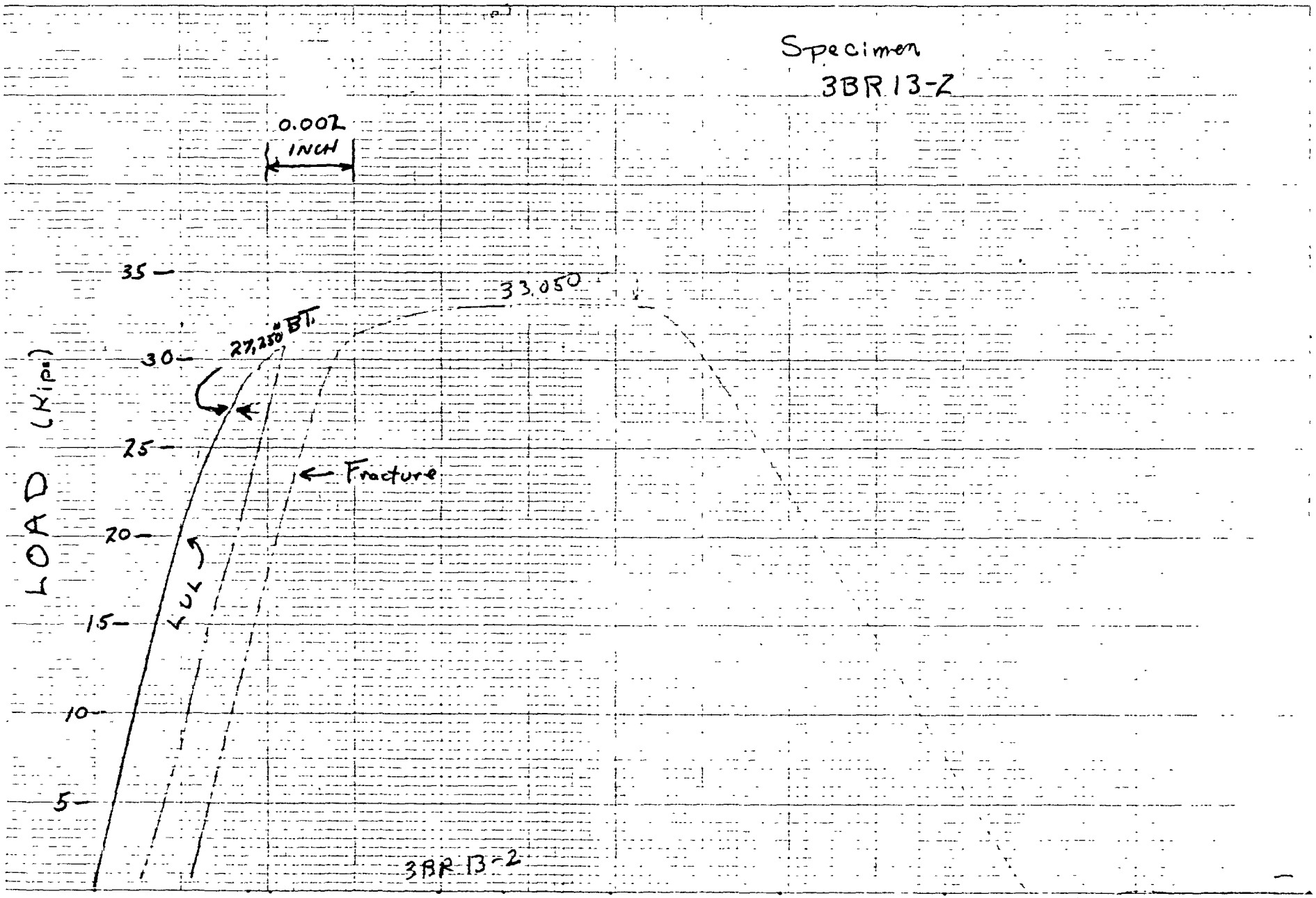

Specimen 2BR 13-1
27,150 LBS.
0.001 INCH
HUL
31,200 LBS.
Fracture
<.008"
LOAD (KIPS)
LOAD (KIPS)
2BR13-1
.001
.002

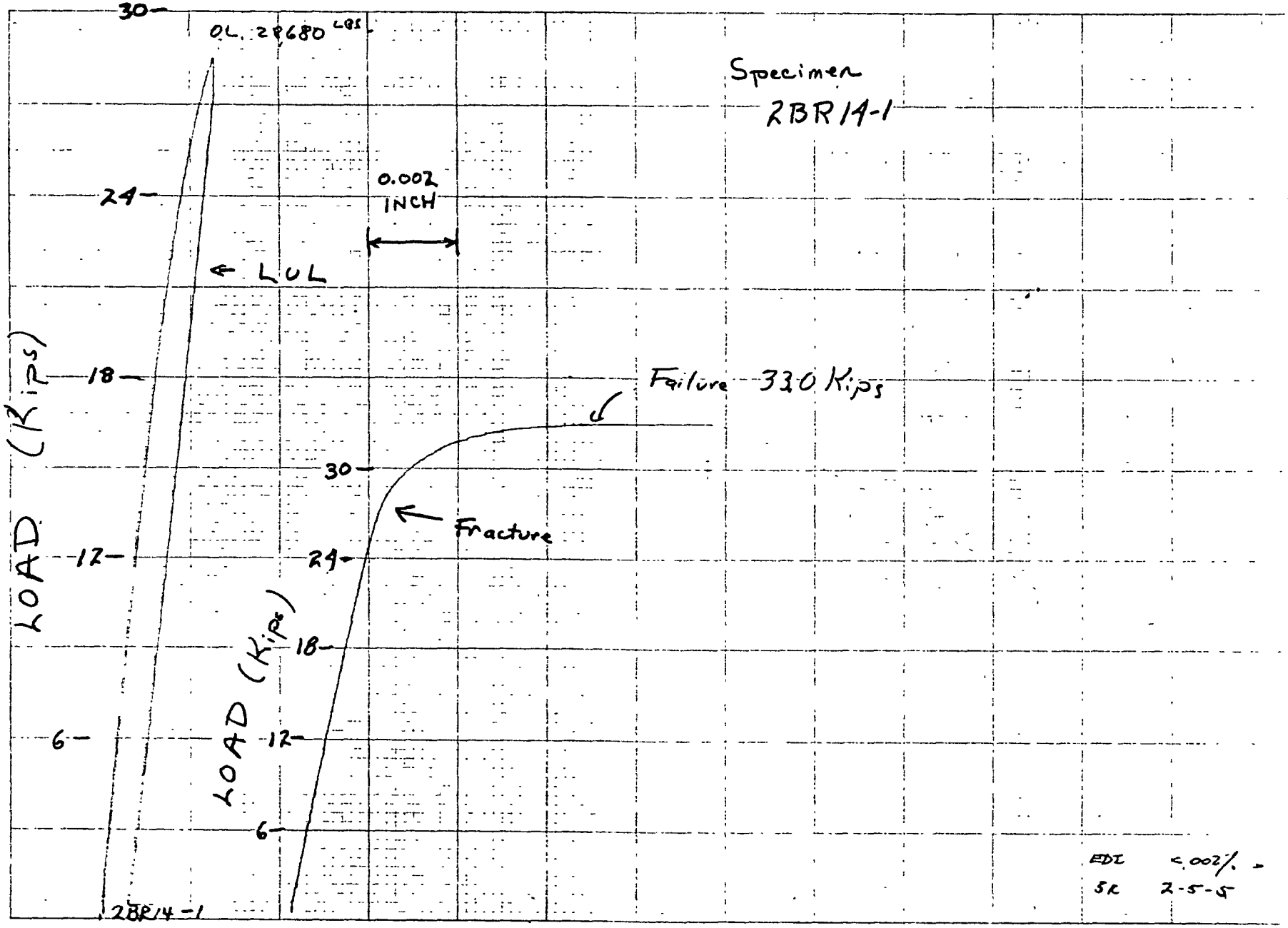

Specimen 2BR13-2
26870 LBS.
0.001 INCH
LUL
LOAD (KIPS)
24
18
12
6
30
24
18
12
6
32,280 LBS.
Fracture
<.001">
2BR13-2

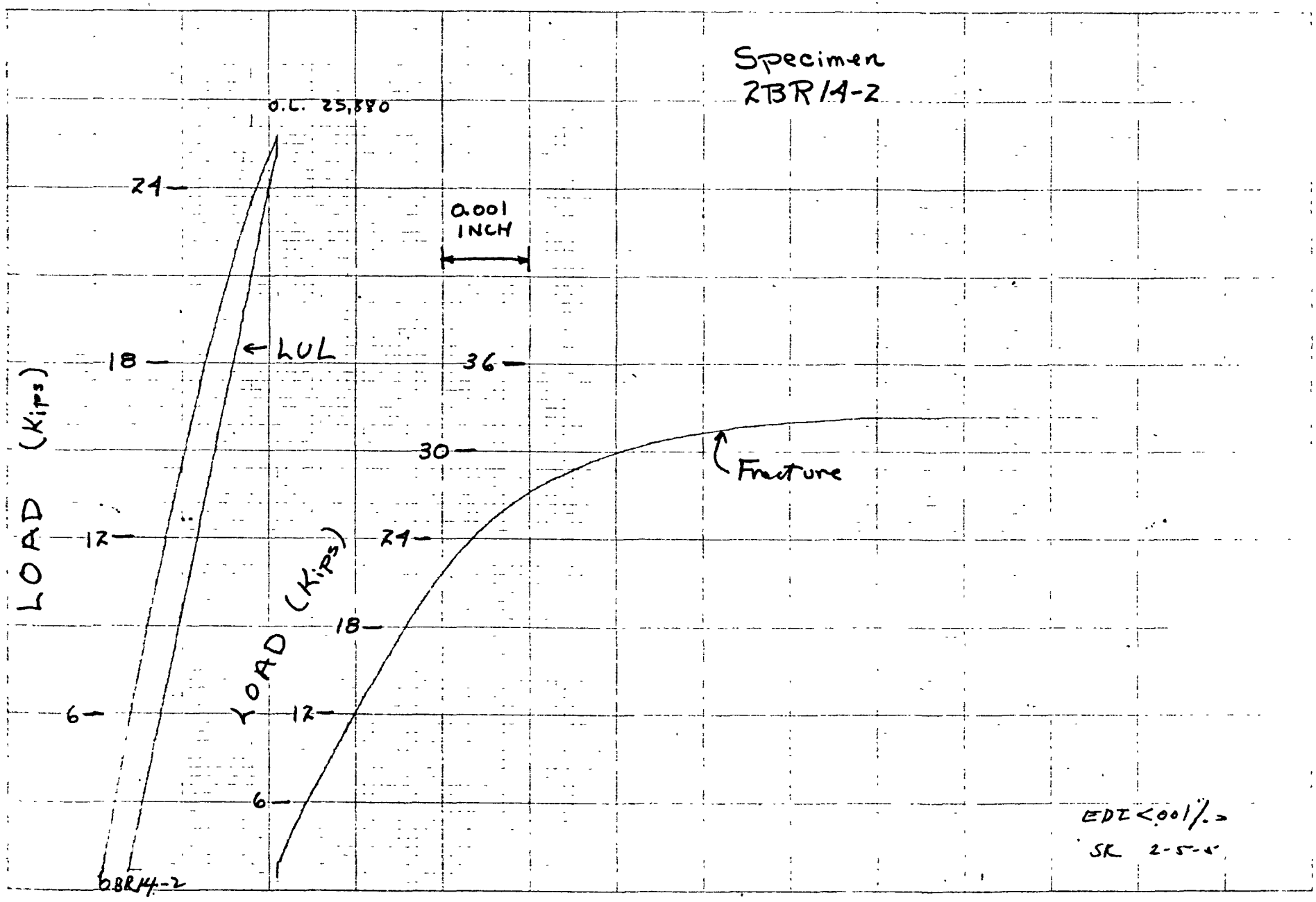

Specimen
ZBR 13-3
0.001 INCH
LOAD (KIPS)
70
30
24
18
12
6
LUL
32.410
Fracture
<.001" >
2BR13-3

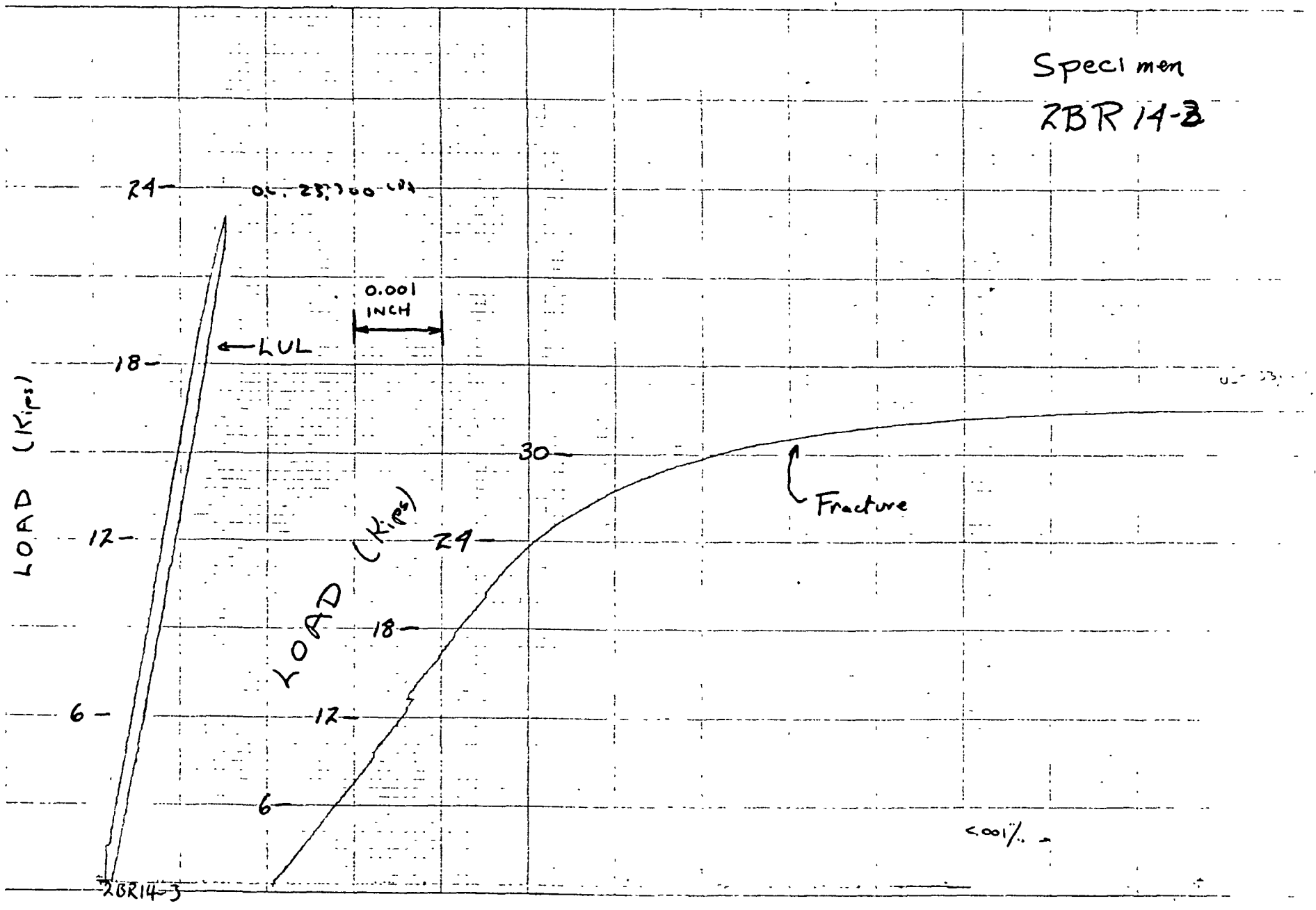

Specimen
2BR 13-4
0.001
INCH
QL. 22,200 LBS.
QL. 24,900 LBS.
LUL
LUL
ULT 32,400 LBS.
Fracture
LOAD (Kips)
LOAD (Kips)
LOAD (Kips)
0
6
12
18
24
30
2BR13-A
< 001/. >
R.T.
3-24-5
JR.


21.7
27.4
QL. 24,660
Specimen
3BR 13-1
0.001
INCH
← LUL
Fracture
LOAD (KIPS)
LOAD (KIPS)
24
18
12
6
0
30
24
18
12
6
0
3BR13-1
R.T
<001 /.>
3-20-5
SL

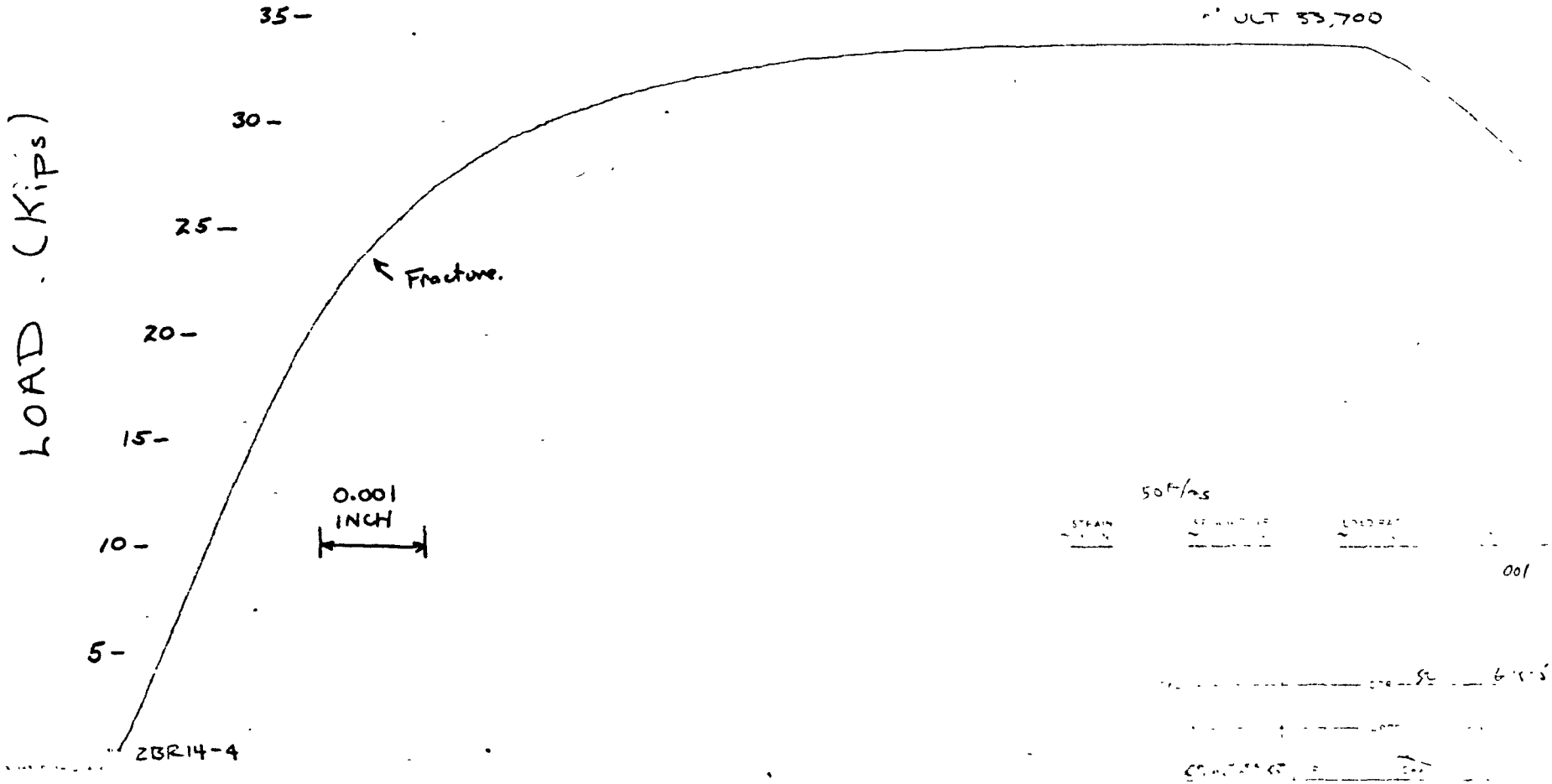

Specimen
3BR13-Z
0.002
INCH
35
30
25
20
15
10
5
LOAD (K_ips)
33,050
27,250 BT.
Fracture
4 K
3BR13-2

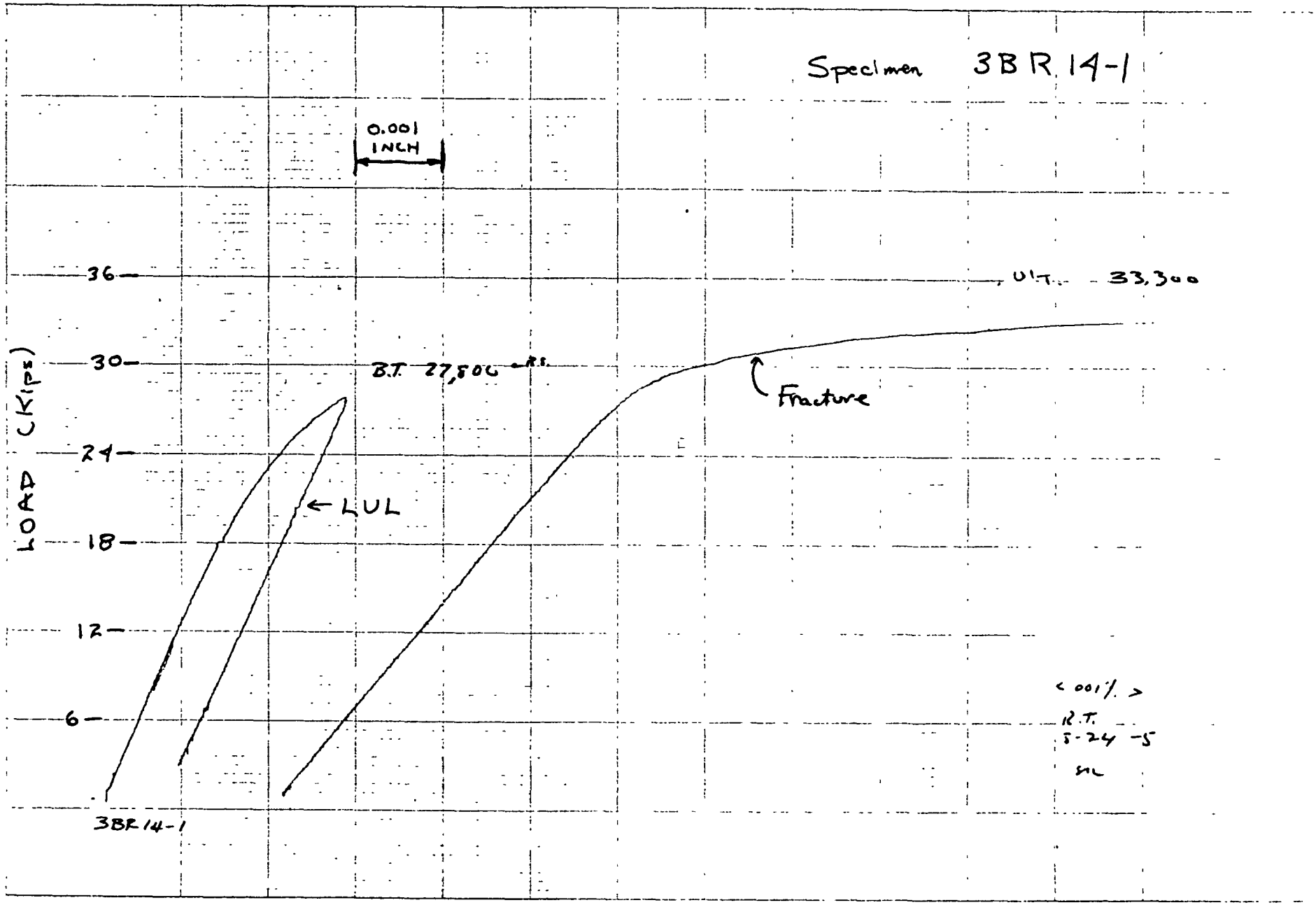

30
24
18
12
6
OL. 28,680 LBS
0.002
INCH
← LUL
LOAD (Kips)
Failure 330 Kips
Fracture
30
24
18
12
6
LOAD (Kips)
2BR14-1
Specimen
2BR14-1
EDI
SK
< .002"
2-5-5


Specimen
2BR14-2
O.L. 25,880
24
18
12
6
LOAD (Kips)
← LUL
0.001
INCH
36
30
24
18
12
6
LOAD (Kips)
Fracture
EDI <.001"/.>
SK 2-5-4
6BR14-2

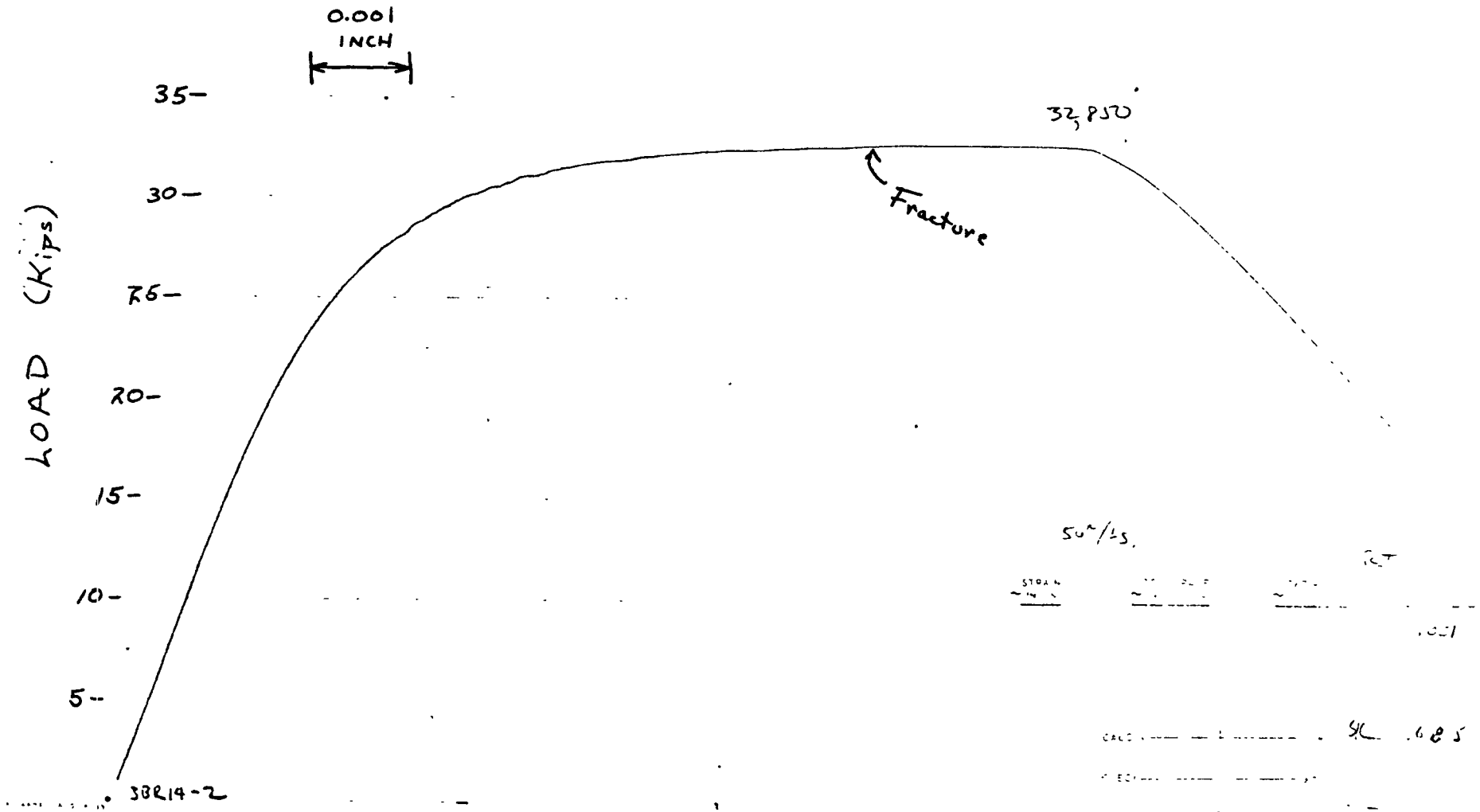

Specimen
2BR14-3
24
18
12
6
LOAD (Kips)
0.001
INCH
LUL
30
29
18
12
6
LOAD (Kips)
Fracture
<.001"
2BR14-3

Specimen
ZBR 14-4

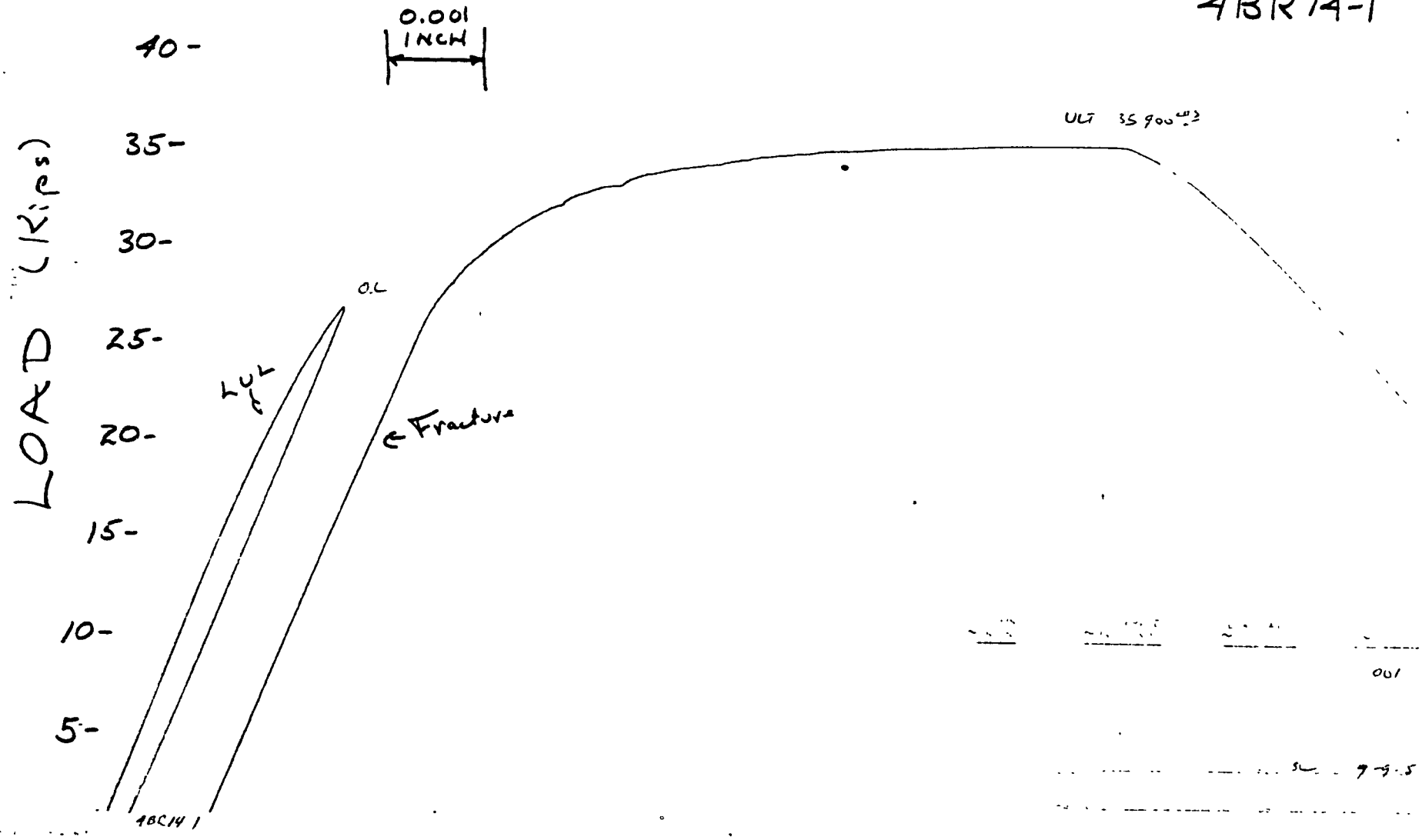



Specimen 3BR14-1
0.001 INCH
LOAD (Kips)
36
30
24
18
12
6
ULT. 33,300
B.T. 27,500 lbs.
Fracture
← LUL
3BR14-1
< 001 / >
R.T.
5-24-5
SHL

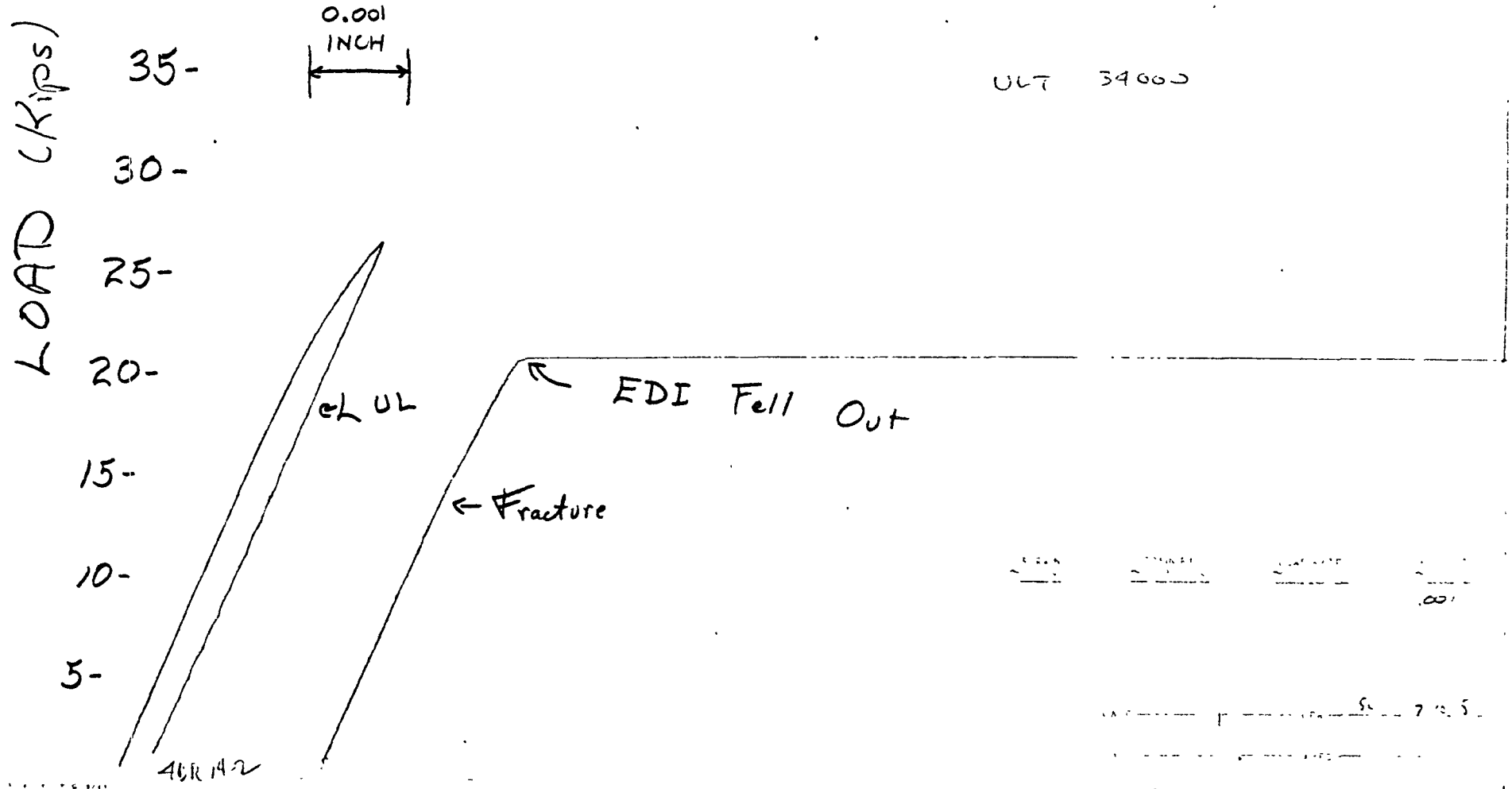
Specimen
3BR 14-2

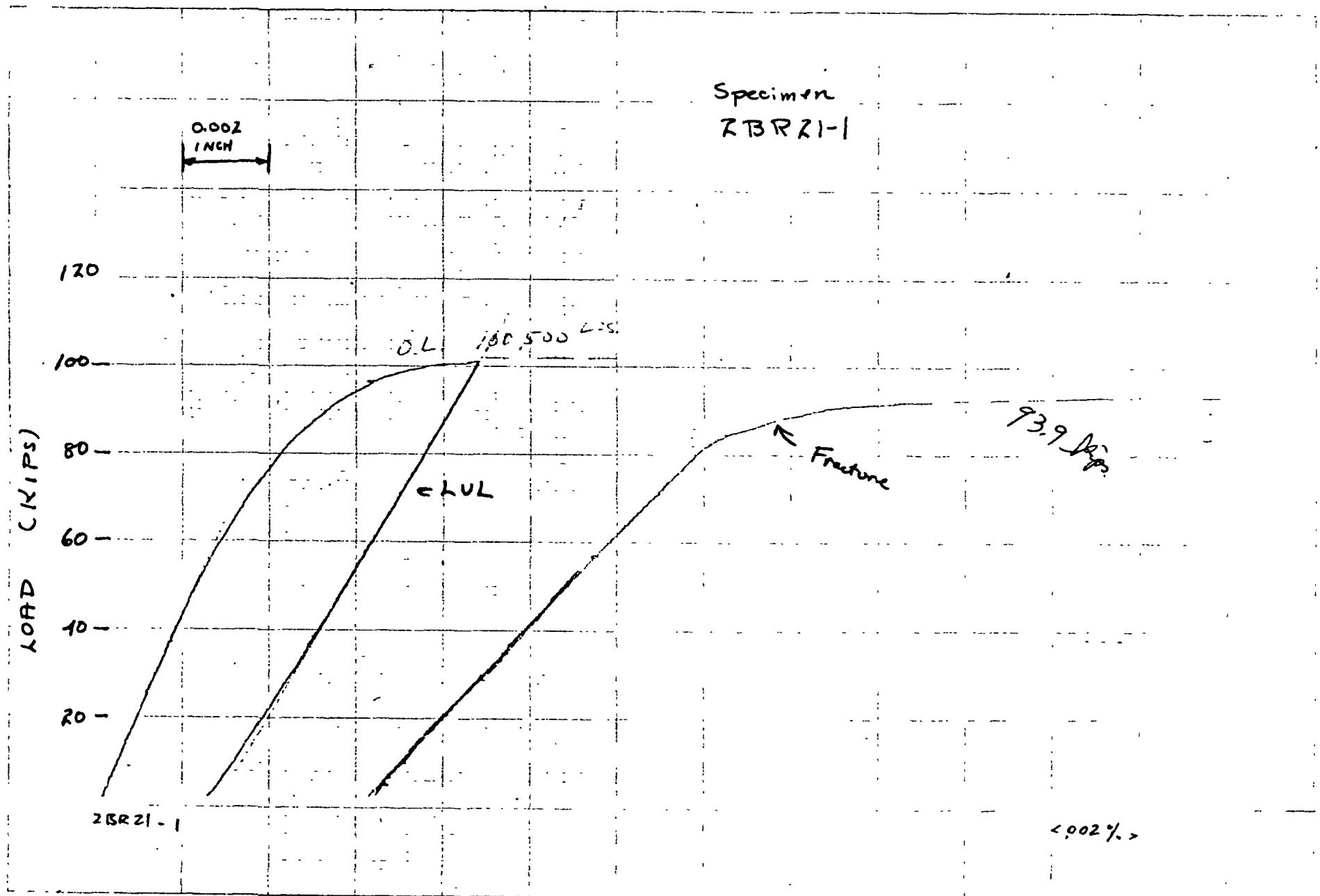


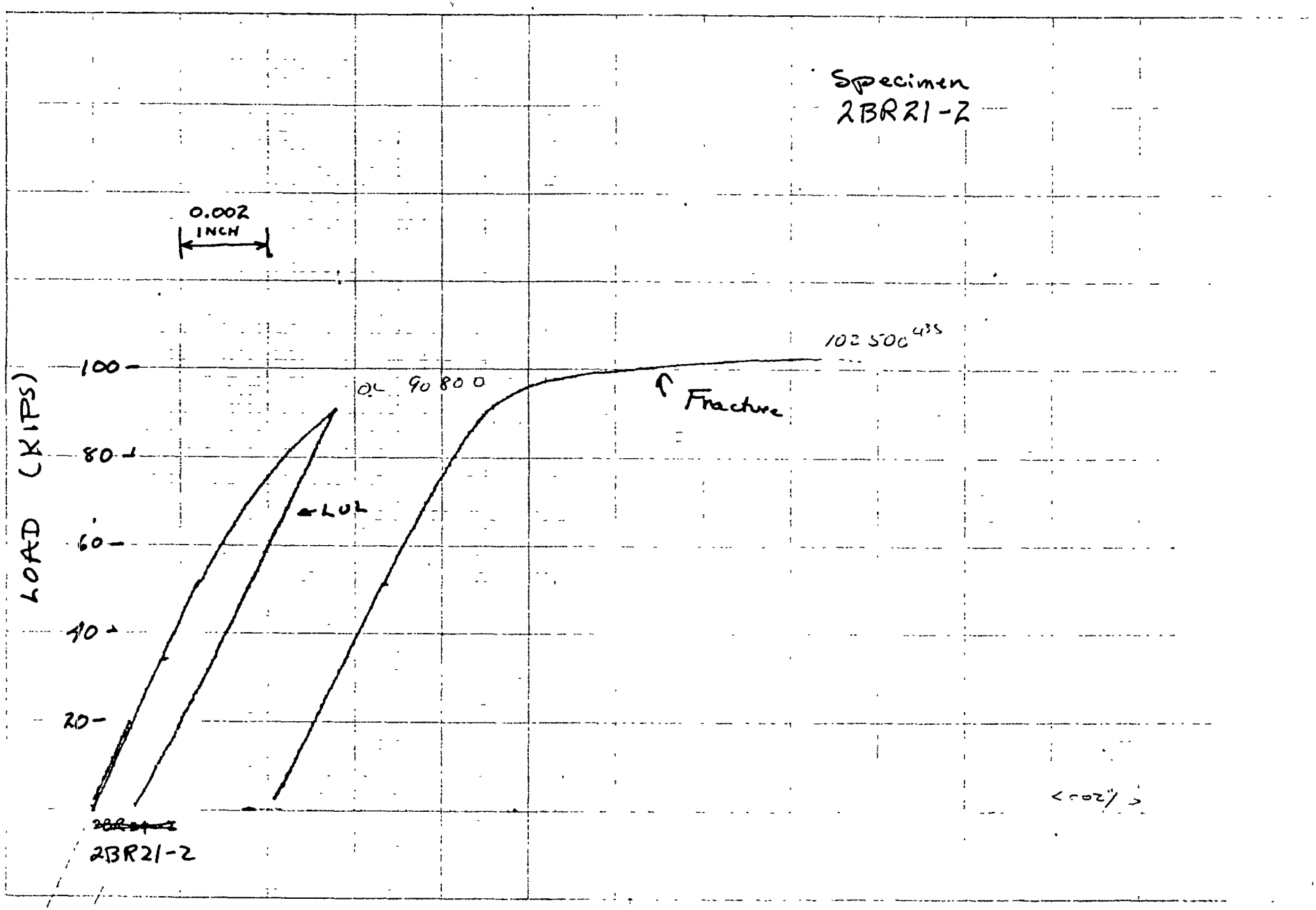
Specimen
4BR14-1

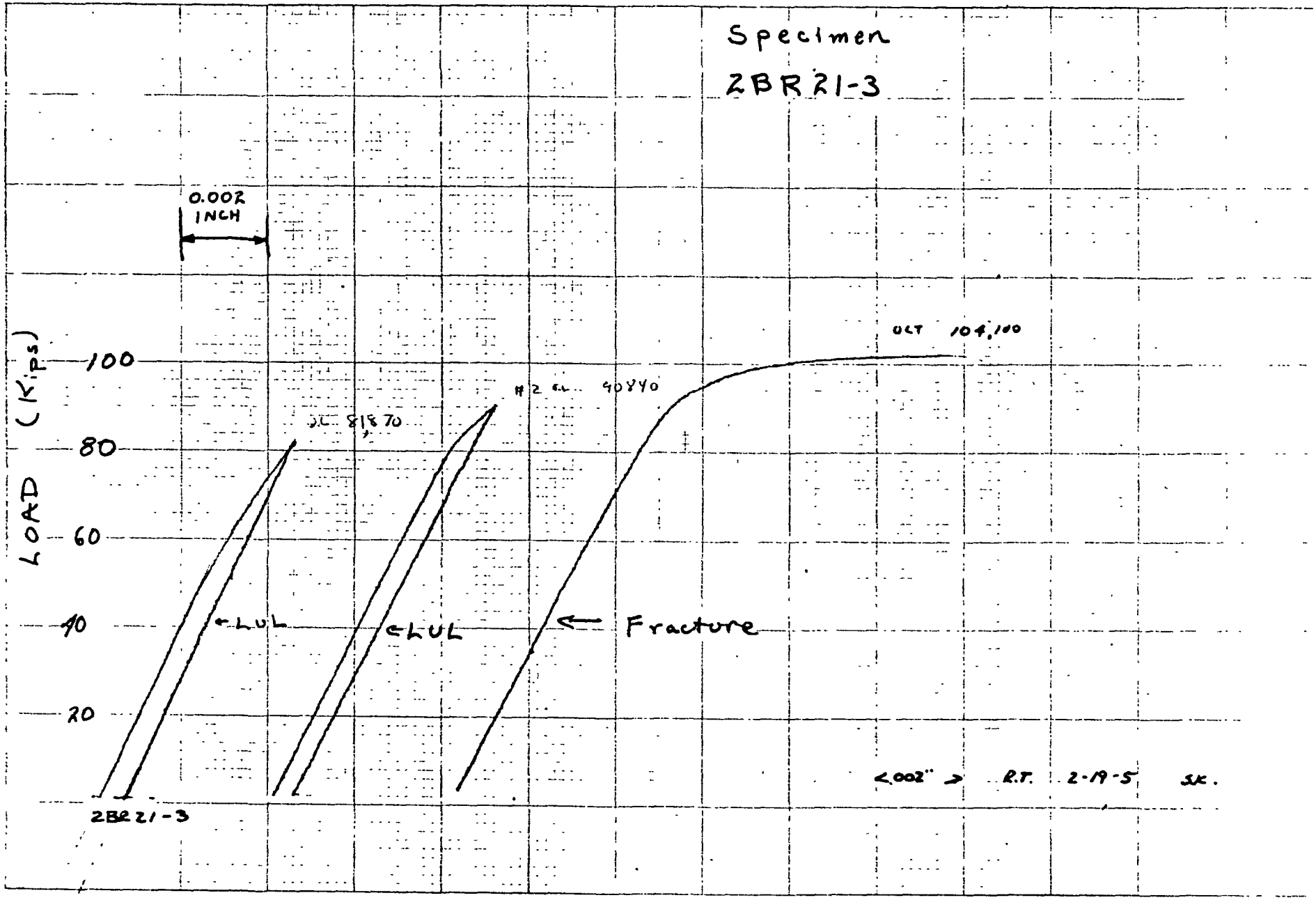


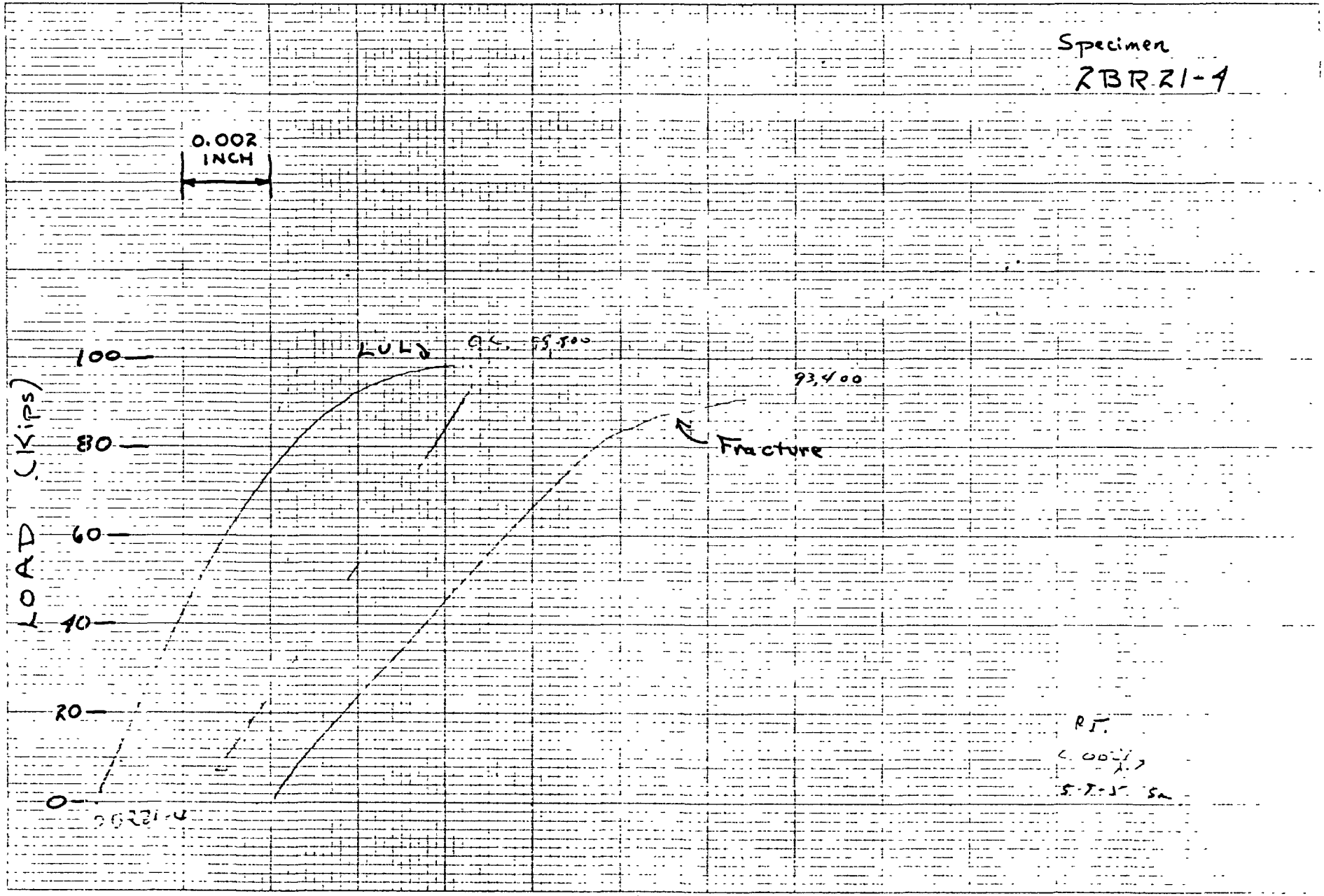
Specimen
4BR14-2

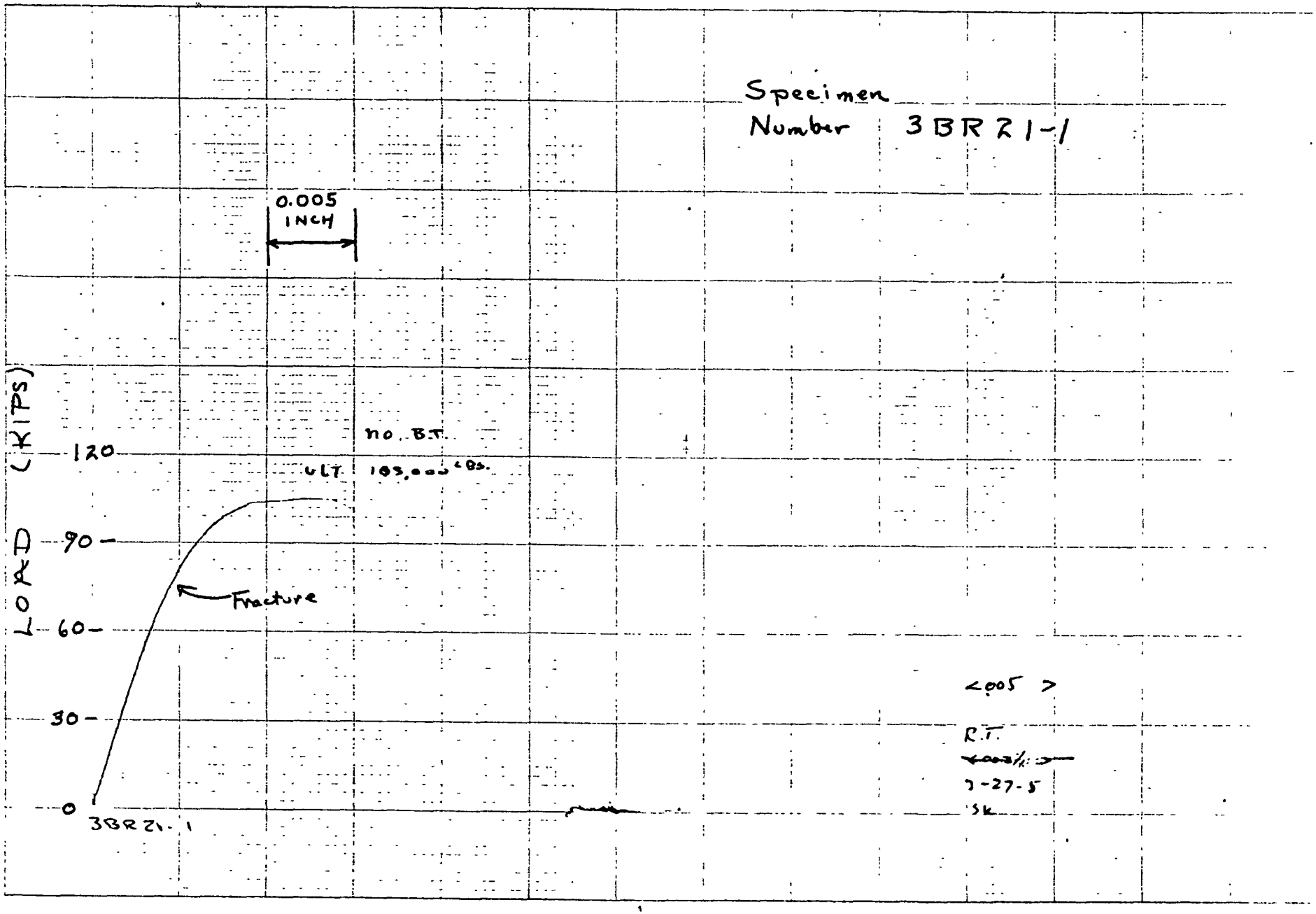


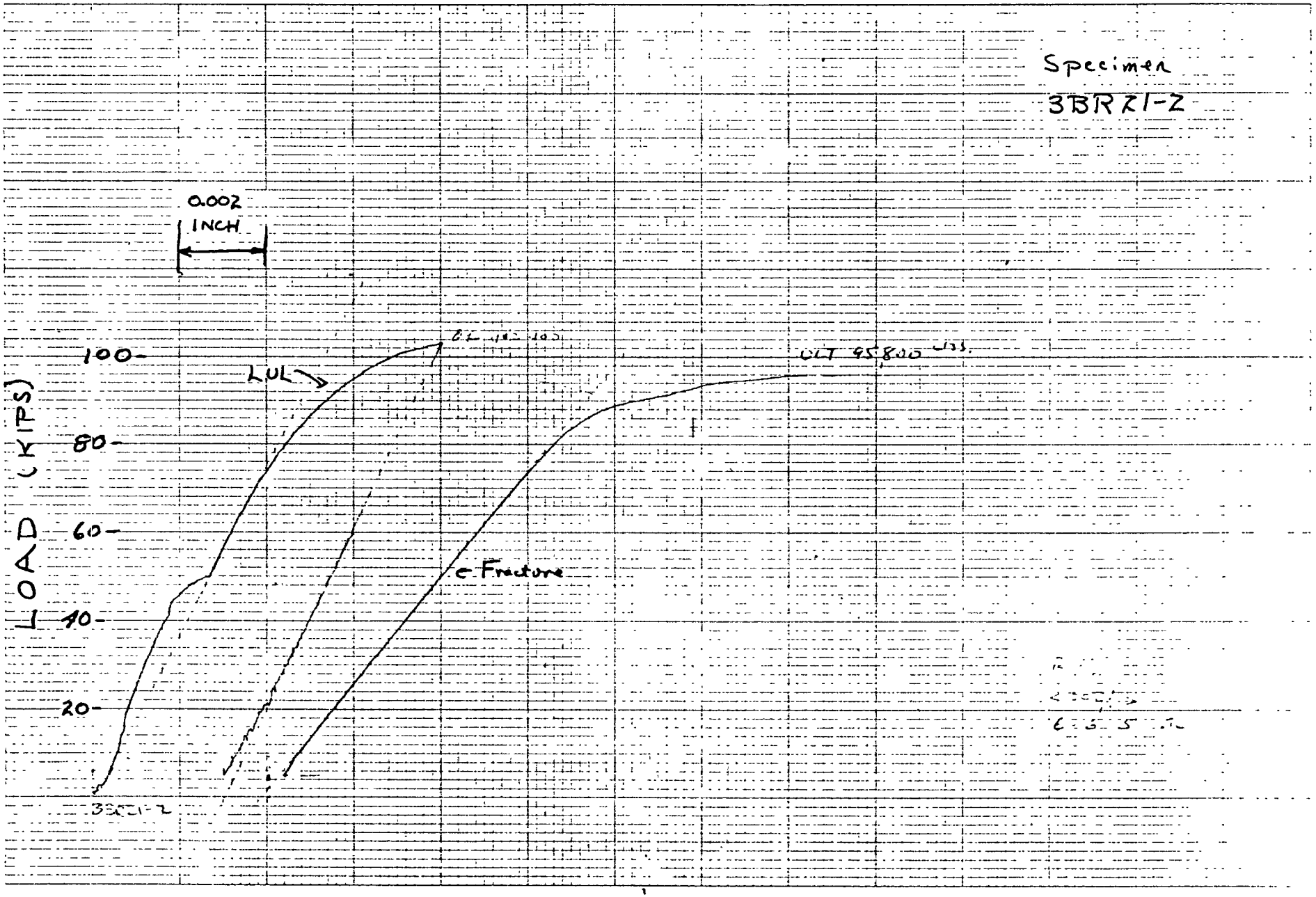

Specimen
2BR21-1
0.002
INCH
120
100
80
60
40
20
LOAD (KIPS)
O.L
100,500 LBS.
ε LUL
Fracture
93.9 kips
2BR21-1
<.002%>

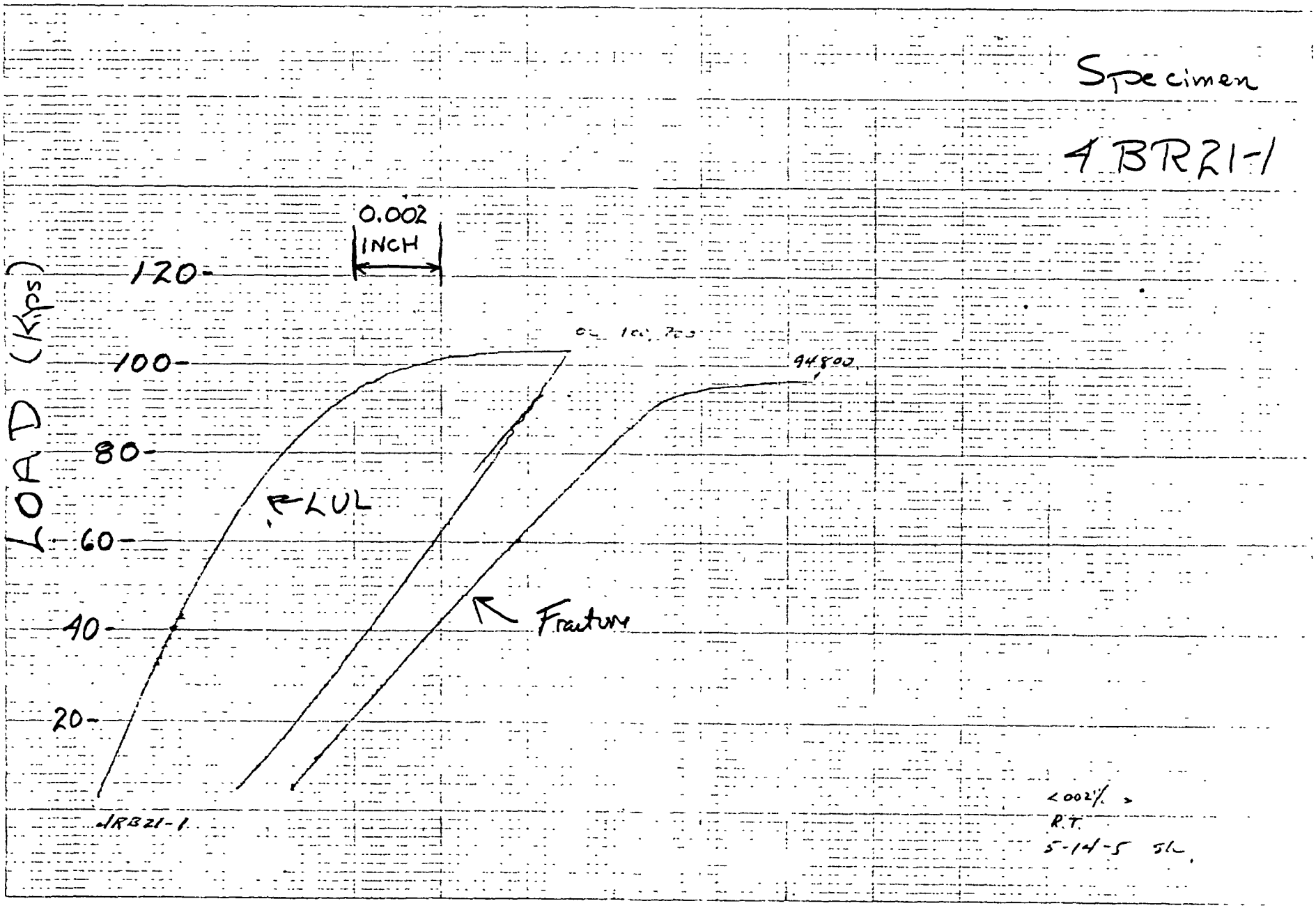

Specimen
2BR21-2
0.002
INCH
LOAD (KIPS)
100
80
60
40
20
90800
Fracture
102500 ULS
2BR21-2

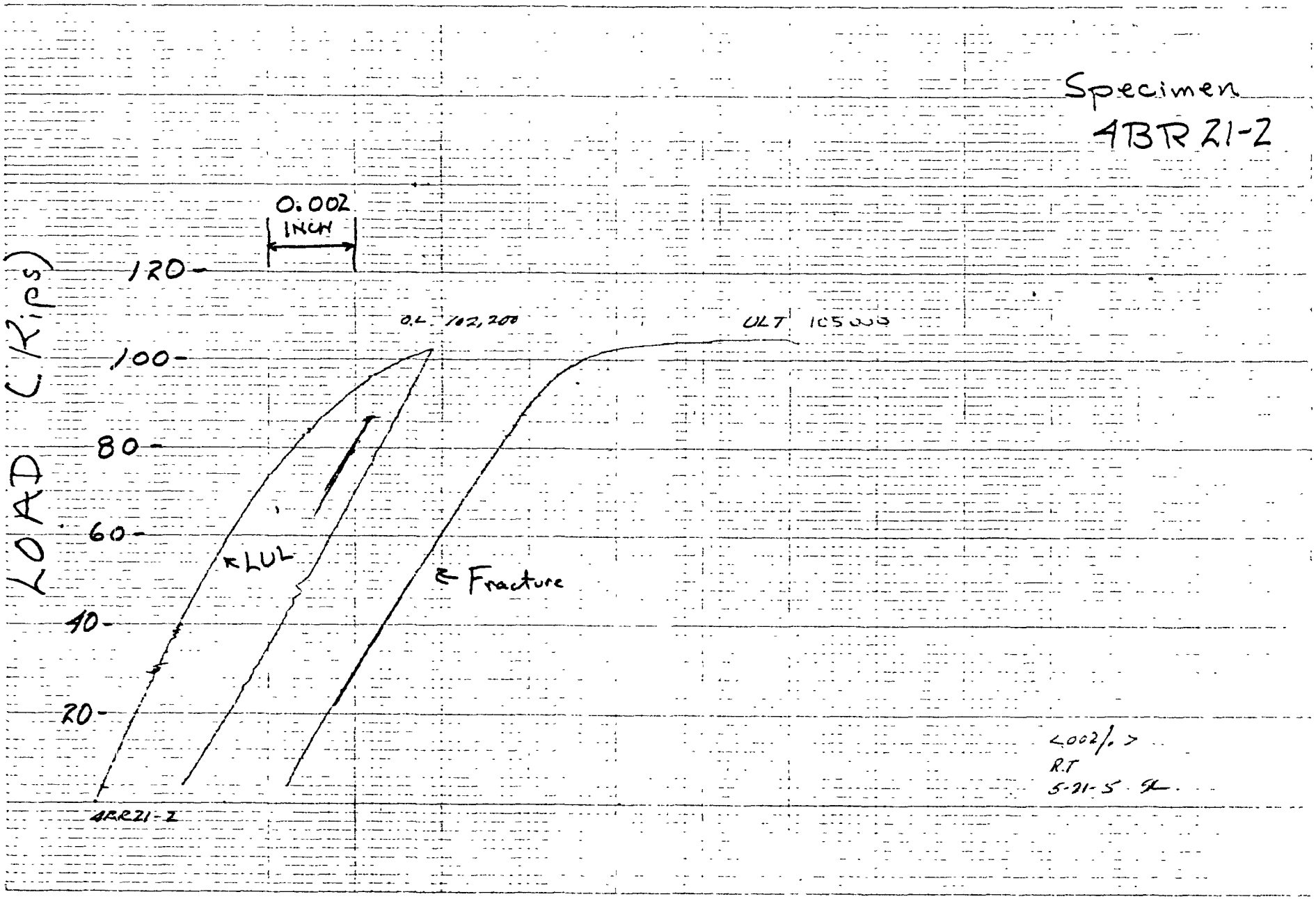

Specimen
2BR21-3
0.002 INCH
LOAD (KIPS)
100
80
60
40
20
#2 ckt. 90840
ckt 81870
ckt 104,100
← LUL
← LUL
← Fracture
2BR21-3
<.002" > R.T. 2-19-5 sk.

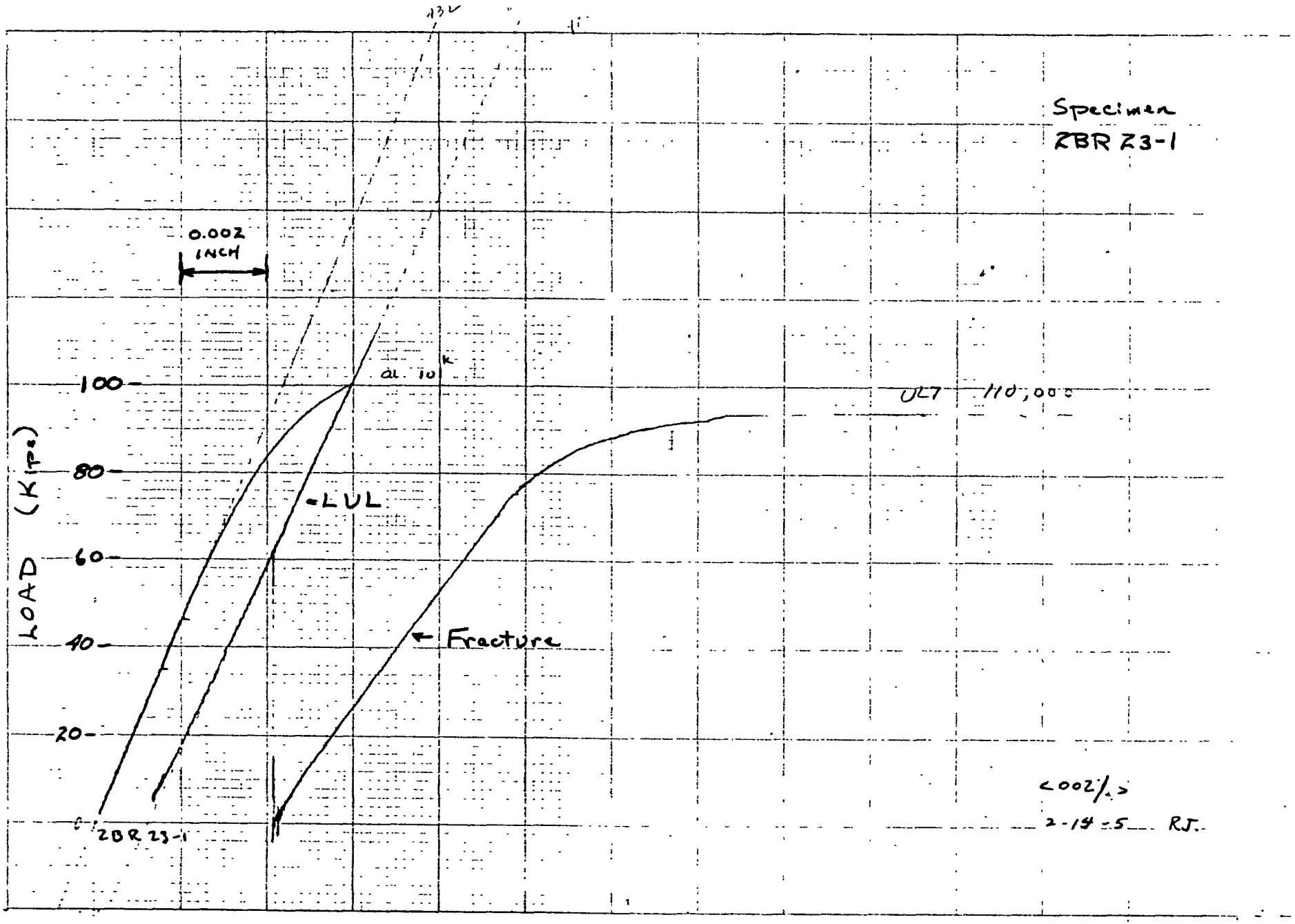

Specimen
2BR21-1
0.002
INCH
LOAD (Kips)
100
80
60
40
20
0
93,400
Fracture
R.T.

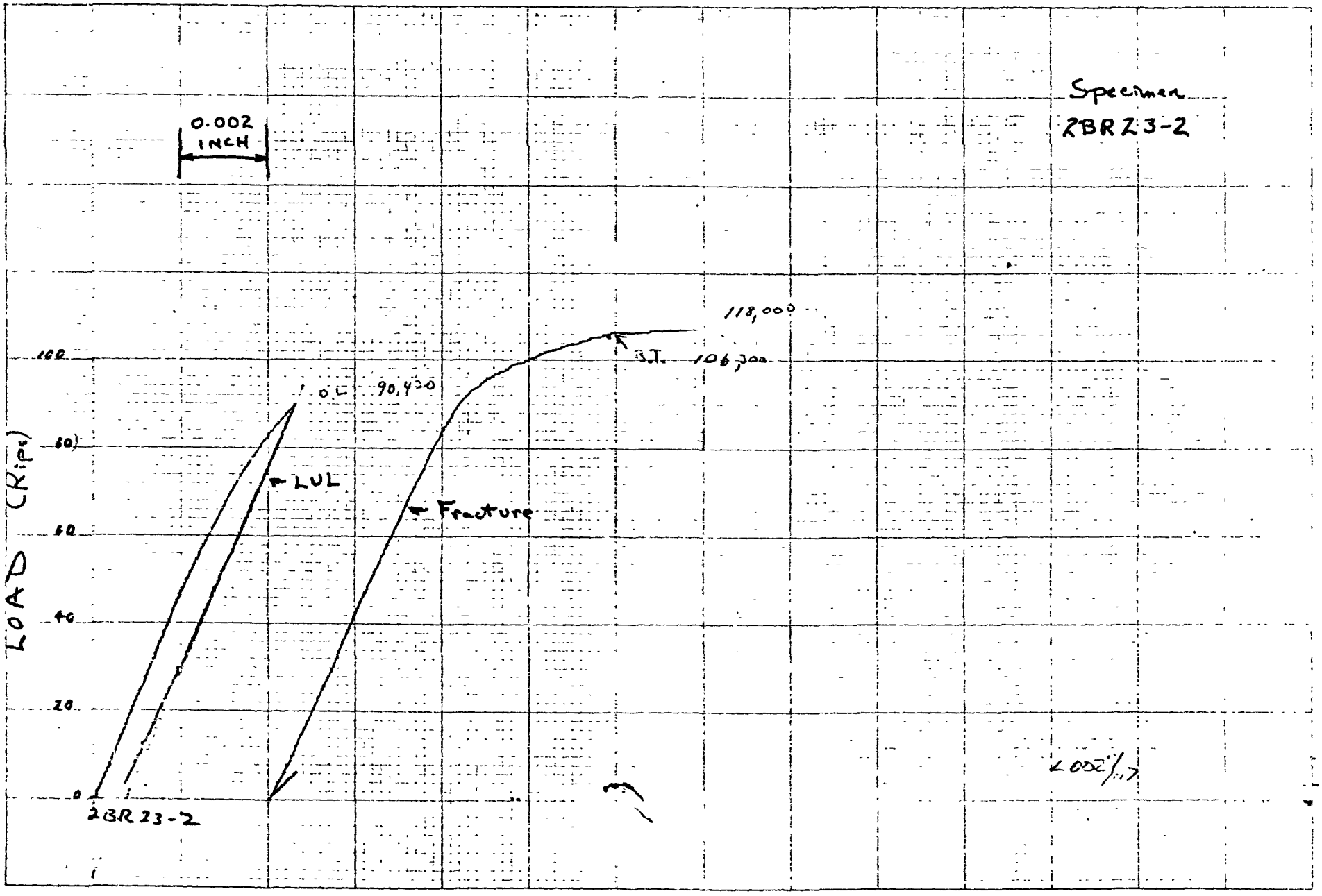

Specimen
Number 3BR21-1
0.005
INCH
LOAD (KIPS)
120
90
60
30
0
no. B.T.
ULT. 105,000 lbs.
Fracture
3BR21-1
<.005>
R.T.
7-27-5
5k

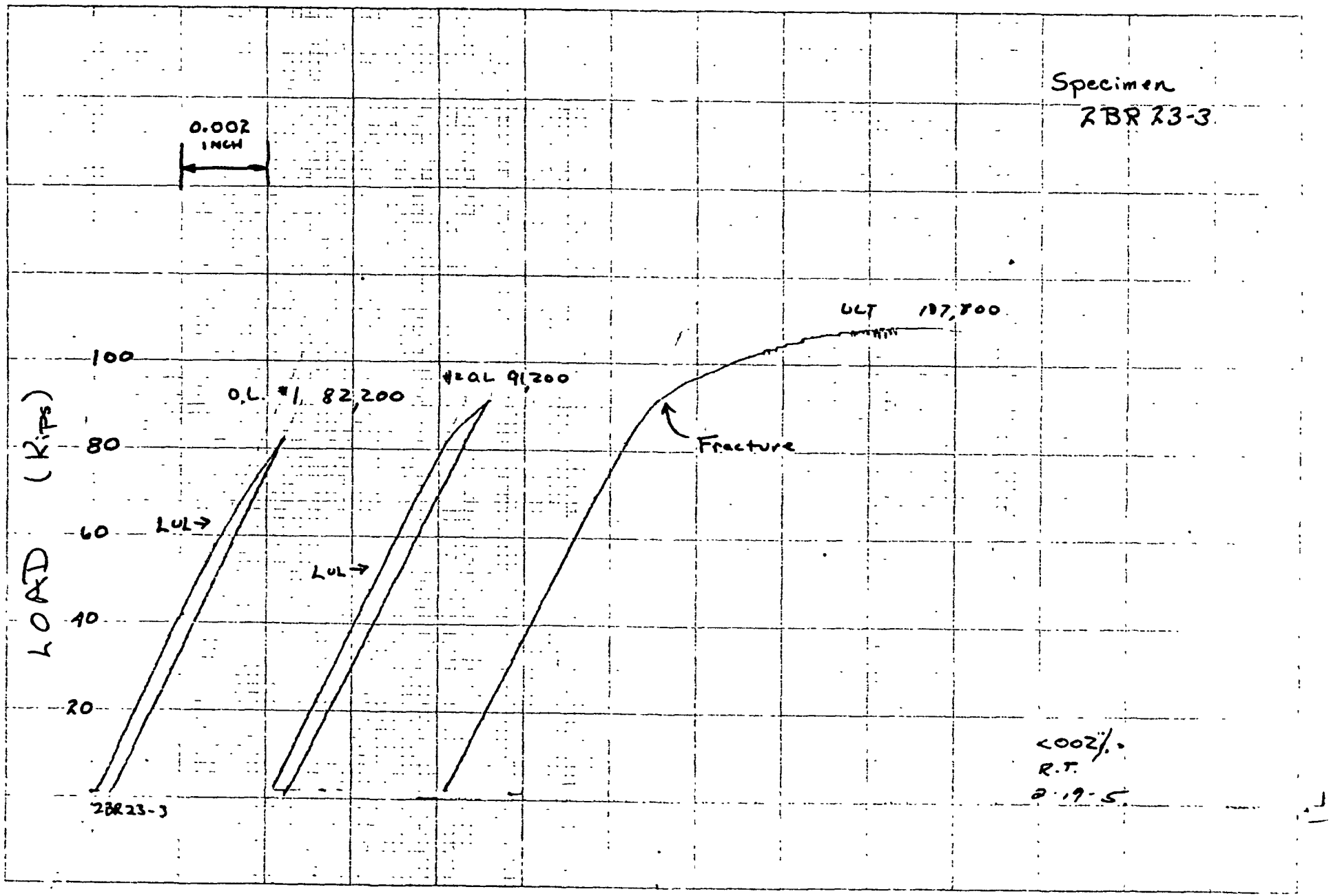

Specimen
3BRZ1-Z
0.002
INCH
LOAD (KIPS)
100
80
60
40
20
ULT 95,800 lbs.
Fracture

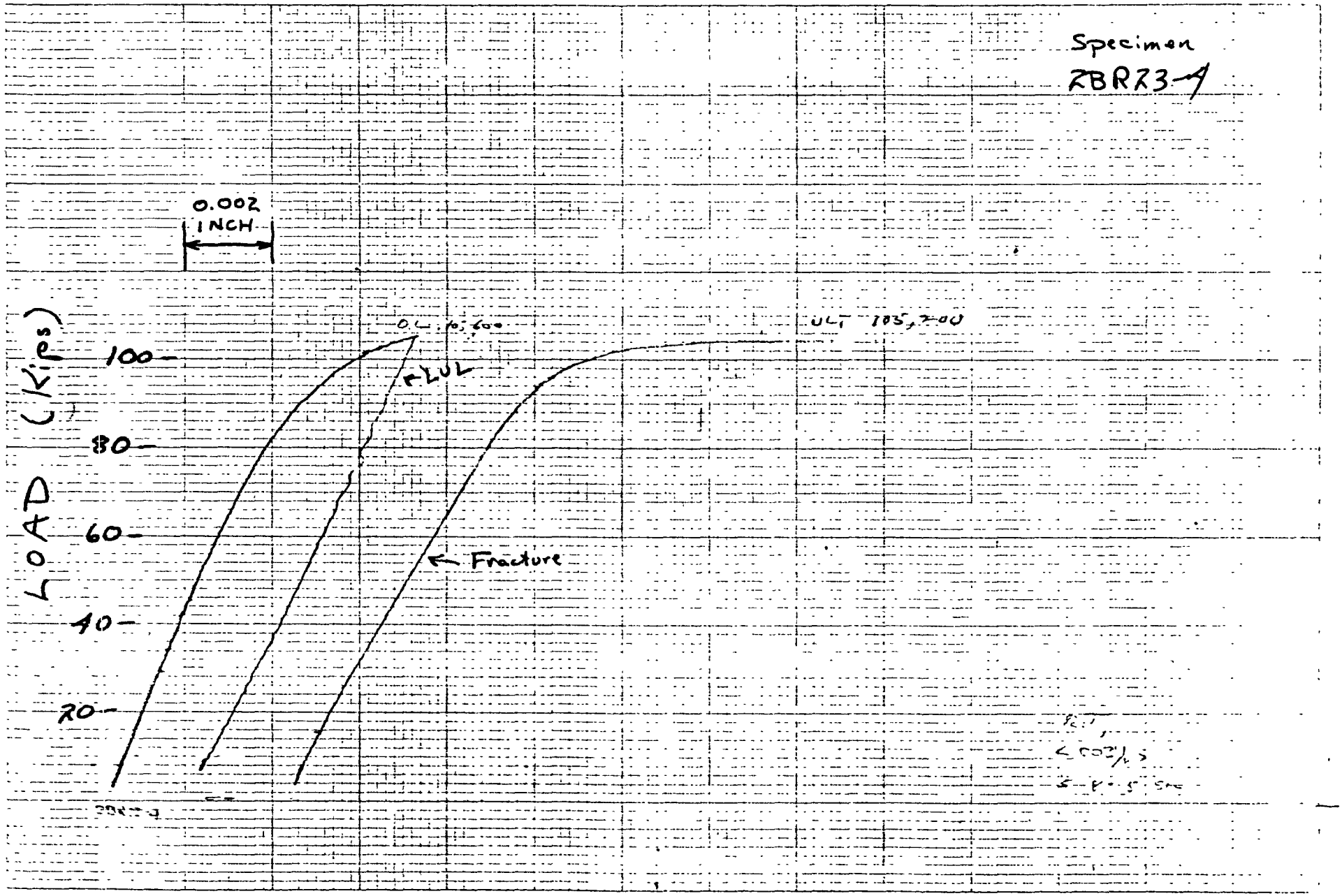

Specimen
4BR21-1
0.002
INCH
120
100
80
60
40
20
LOAD (Kips)
PLUL
94800
Fracture
4RB21-1
<.002"/>
R.T.
5-14-5 SL.


Specimen
4TBR21-2
0.002
INCH
LOAD (Kips)
120
100
80
60
40
20
0.L. 102,200
ULT 105,000
LUL
Fracture
<.002/. >
R.T
5-21-5
4TBR21-2

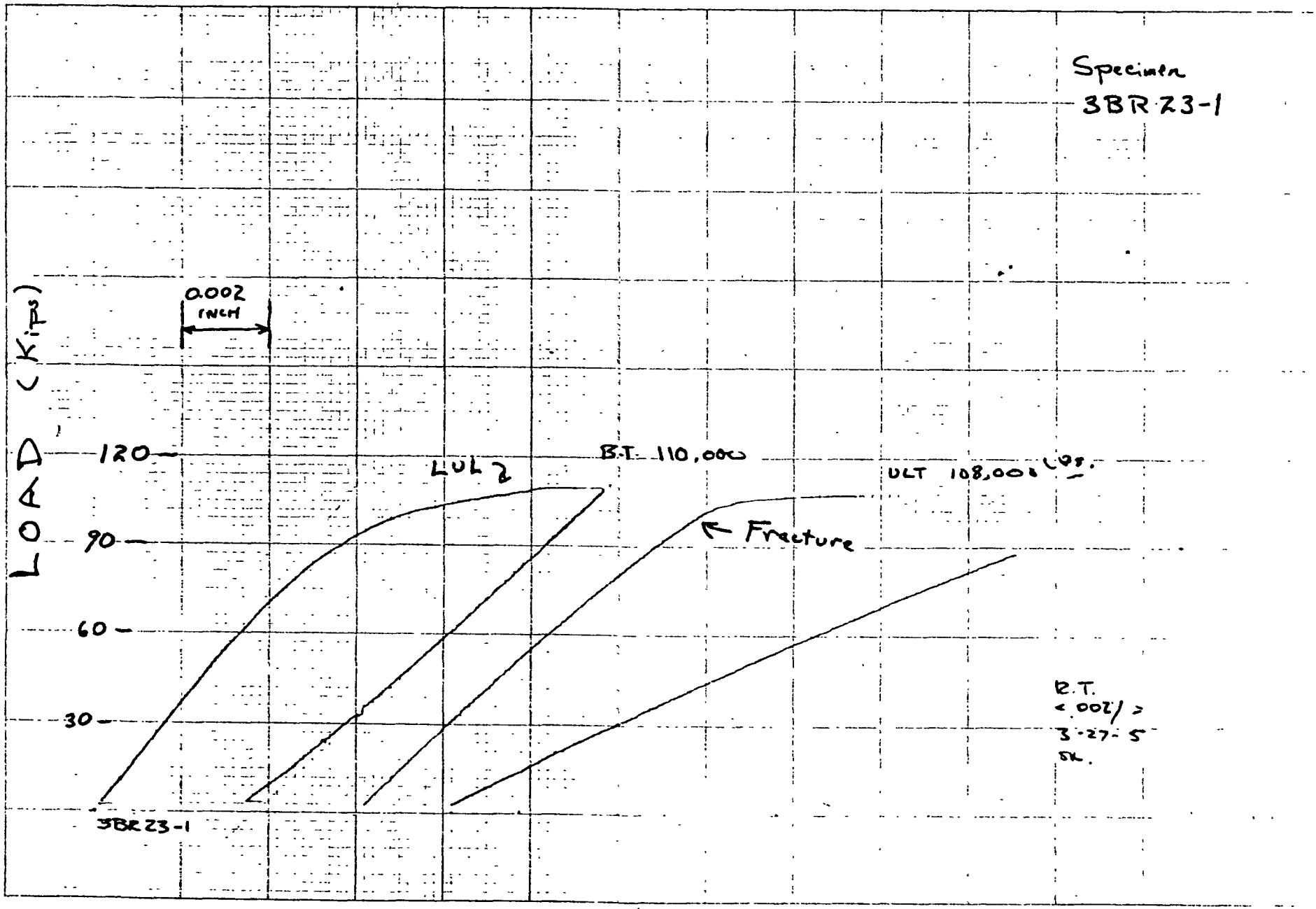

Specimen
ZBR Z3-1
0.002
INCH
100
80
60
40
20
0
LOAD (Kips)
at 10 K
LUL
Fracture
ULT 110,000
ZBR Z3-1
<.002/.>
2-14-5 RJ.

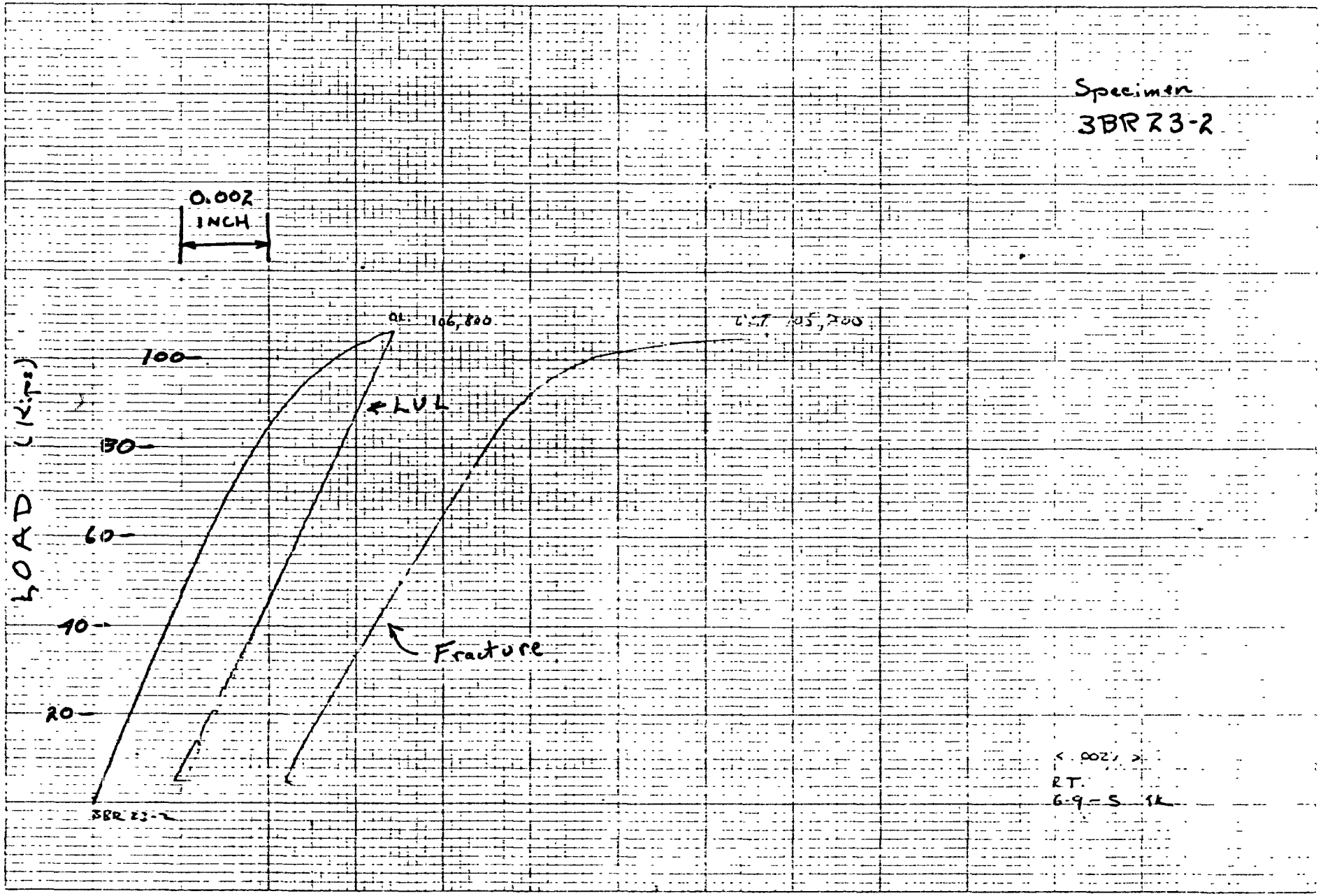

Specimen
2BR23-2
0.002
INCH
LOAD (KIPS)
100
80
60
40
20
0
118,000
B.T. 106,300
Y.P. 90,420
LUL
Fracture
2BR23-2
.002"/in

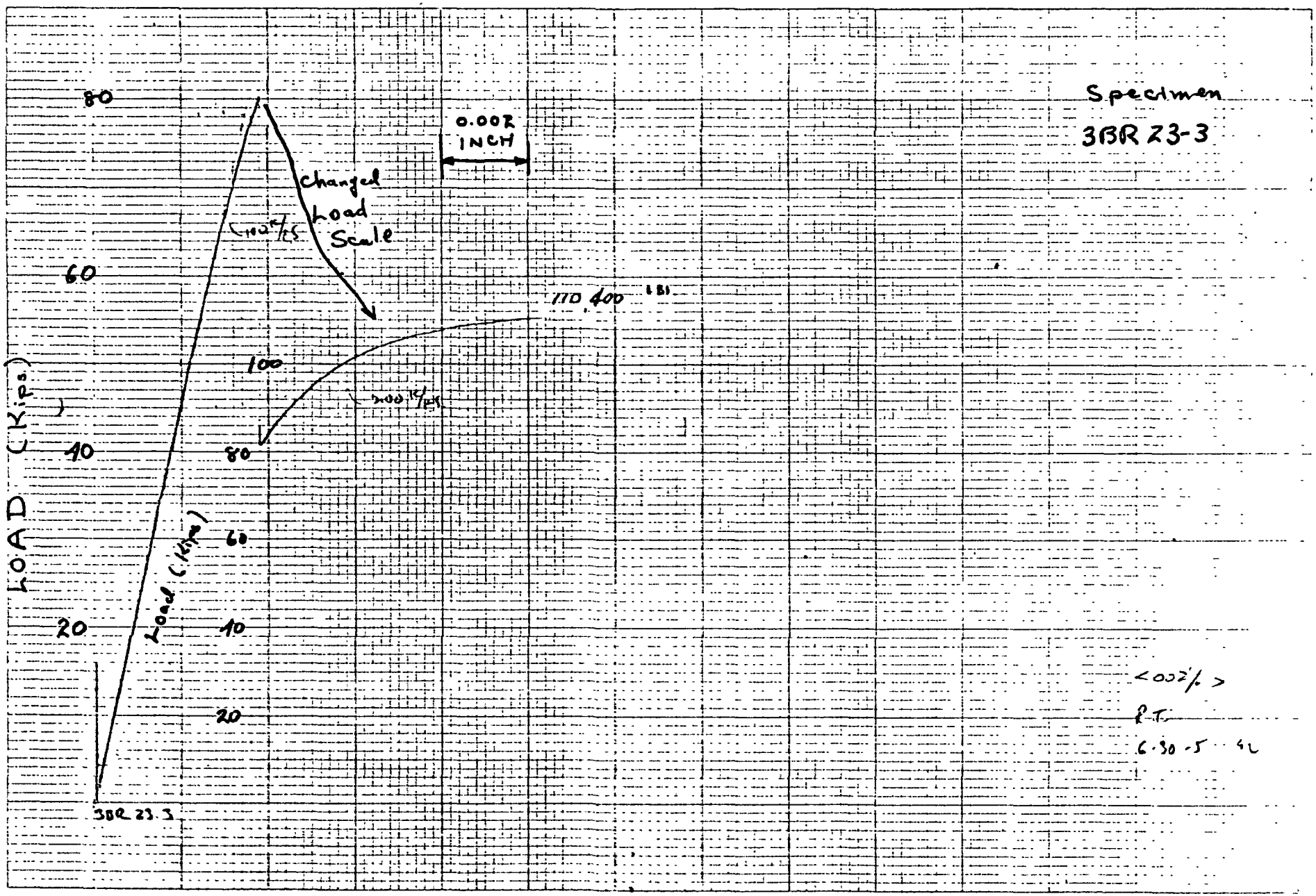

Specimen
ZBR23-3
0.002
INCH
ULT 107,800
100
80
60
40
20
LOAD (KIPS)
0.L. #1 82,200
#2 AL 91,200
LUL→
LUL→
Fracture
ZBR23-3
<002"
R.T.
9-19-5



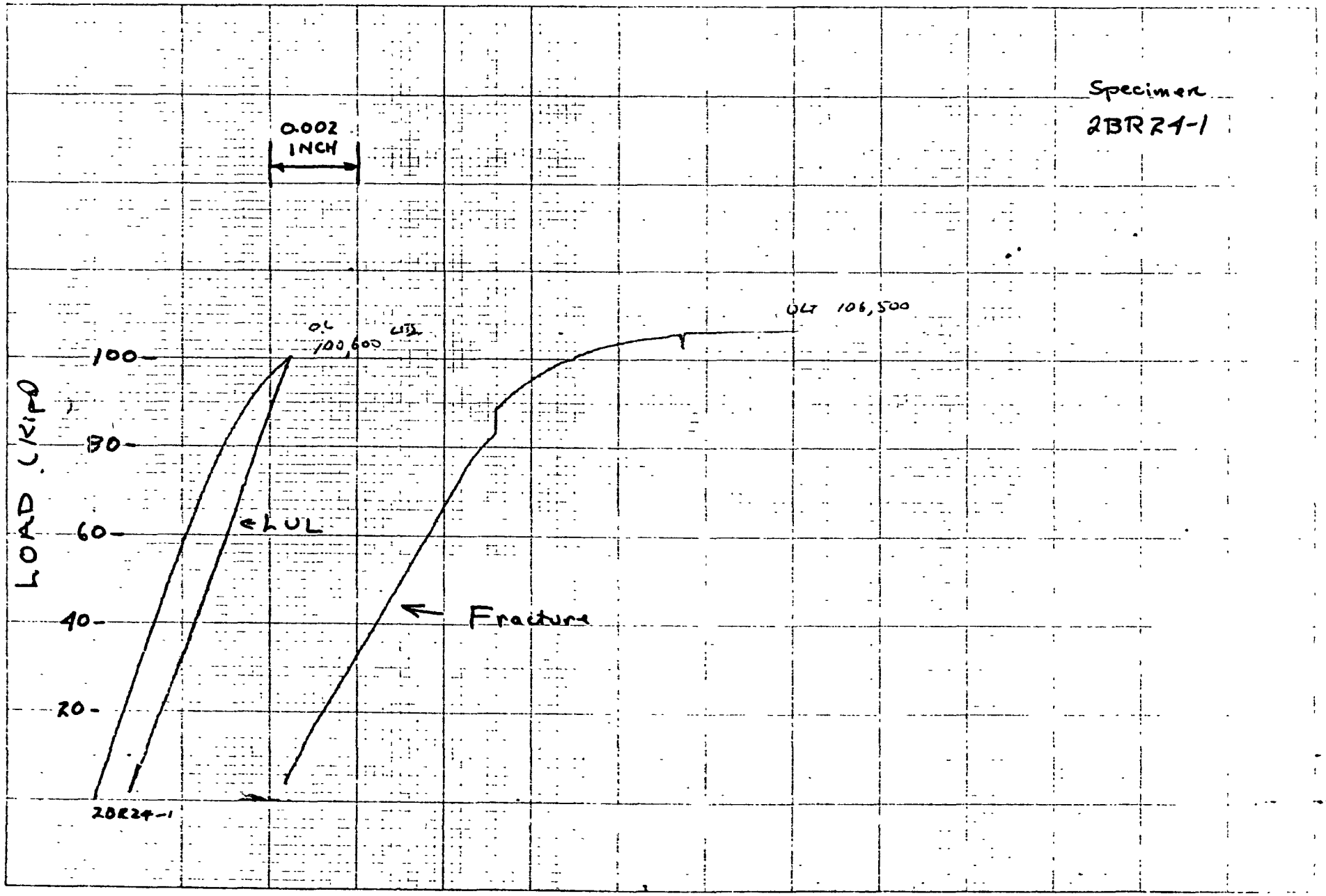
47 0703
16
KOE

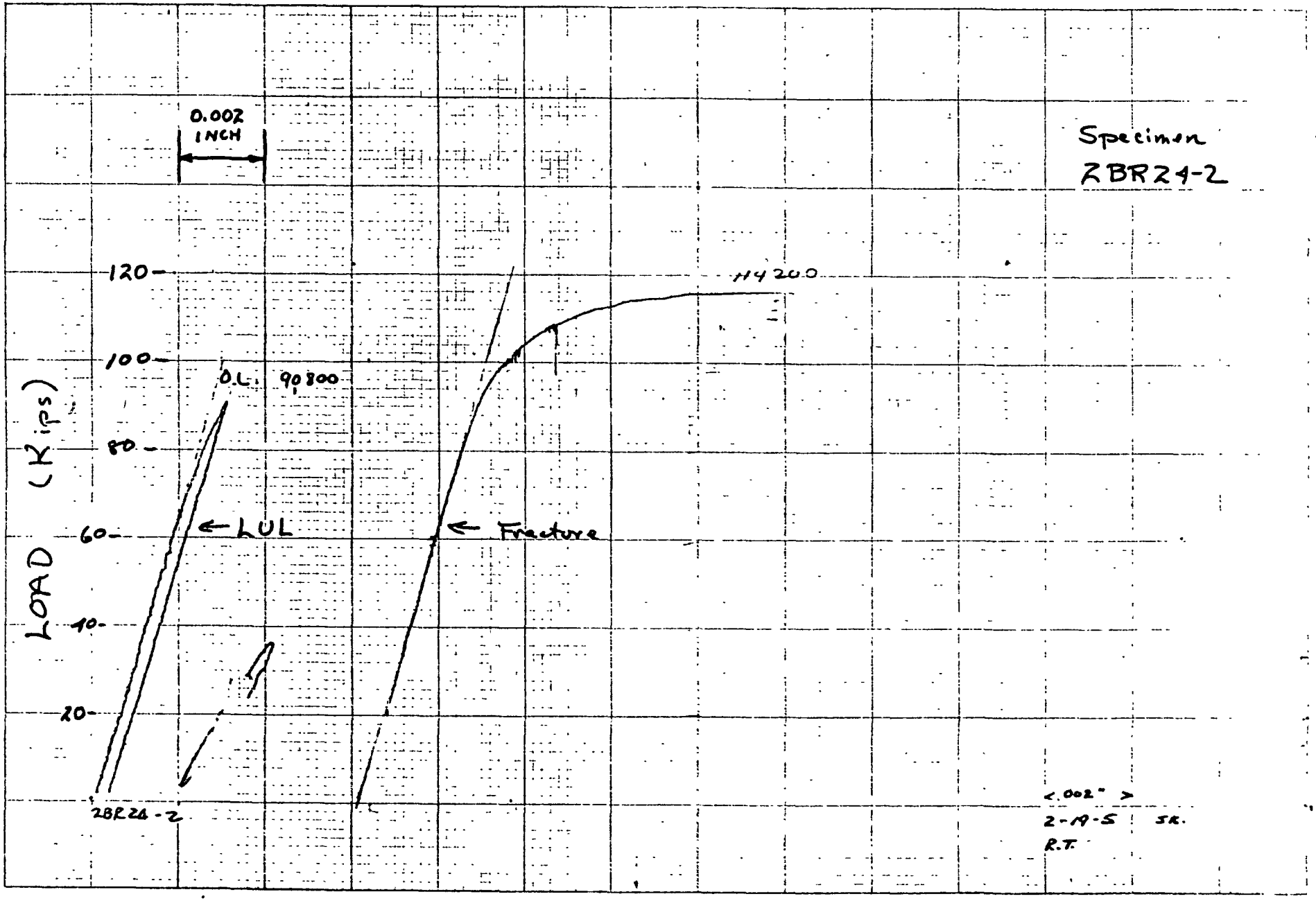

Specimen
3BR23-1
LOAD (Kips)
0.002 INCH
120
90
60
30
3BR23-1
LUL 2
B.T. 110,000
ULT 108,000 Lbs.
Fracture
B.T.
<.002/>
3-27-5
BK.

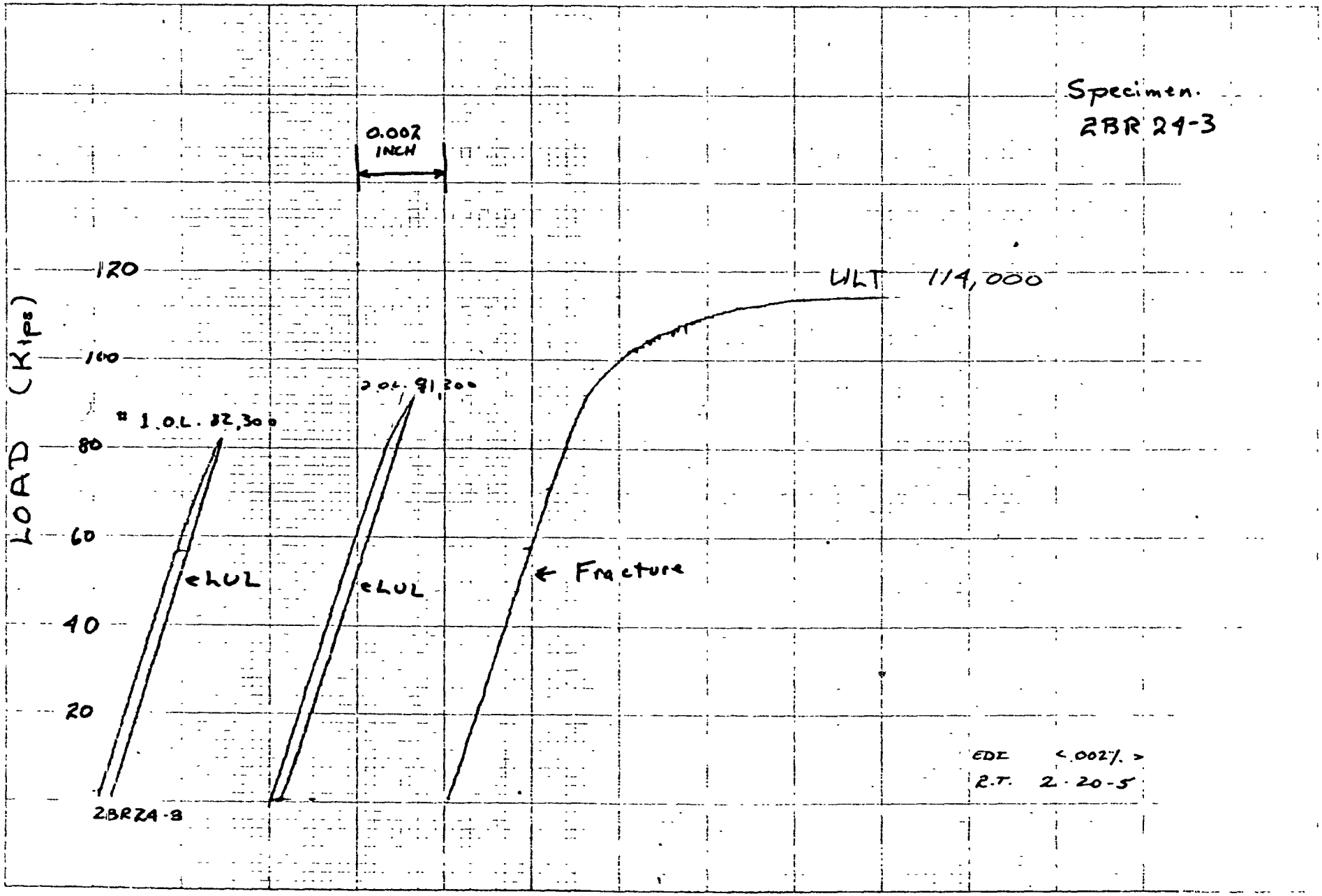

Specimen
3BR23-2
0.002
INCH
LOAD (Kips)
100
80
60
40
20
LVL
Fracture
3BR23-2
RT.
6-9-5

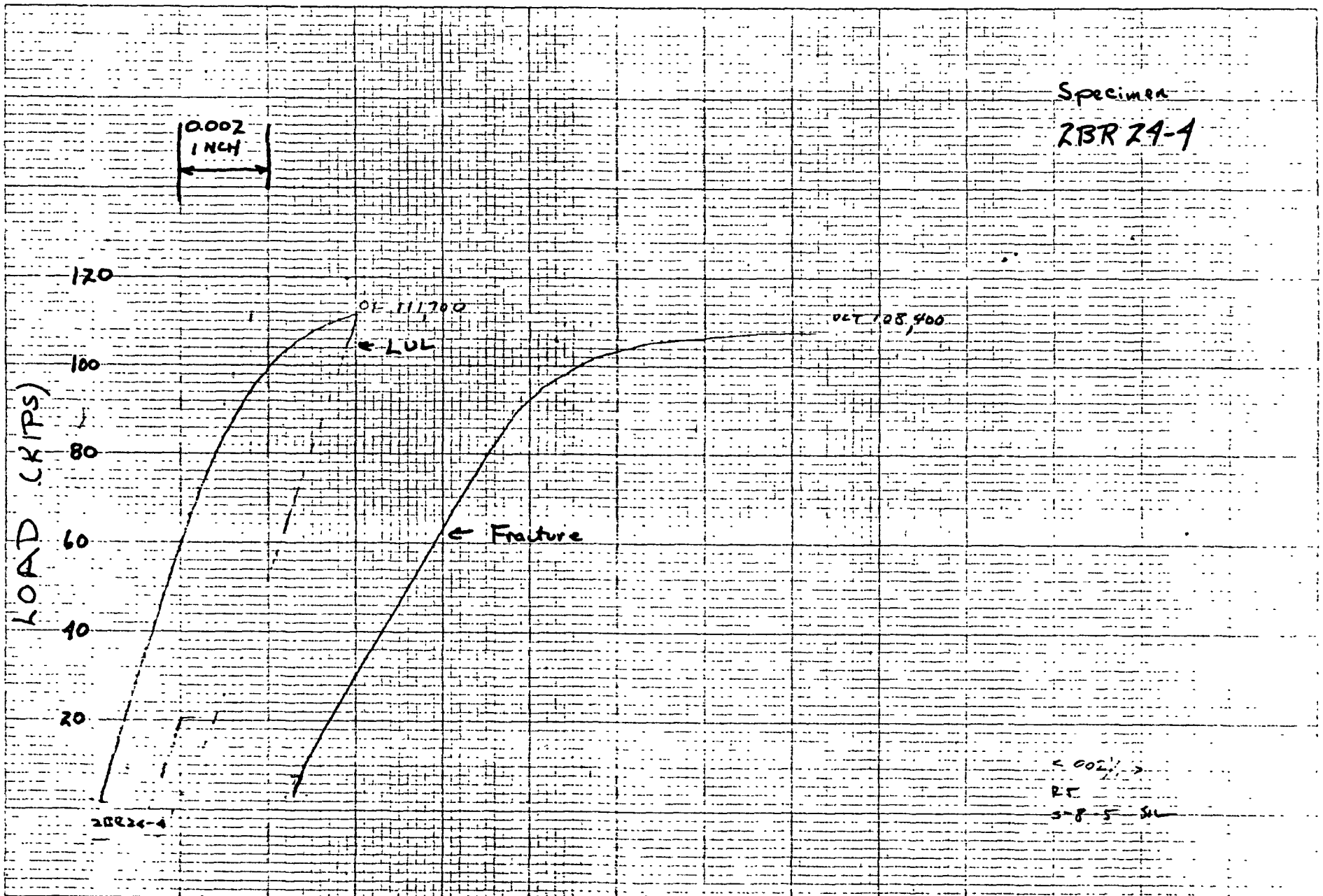


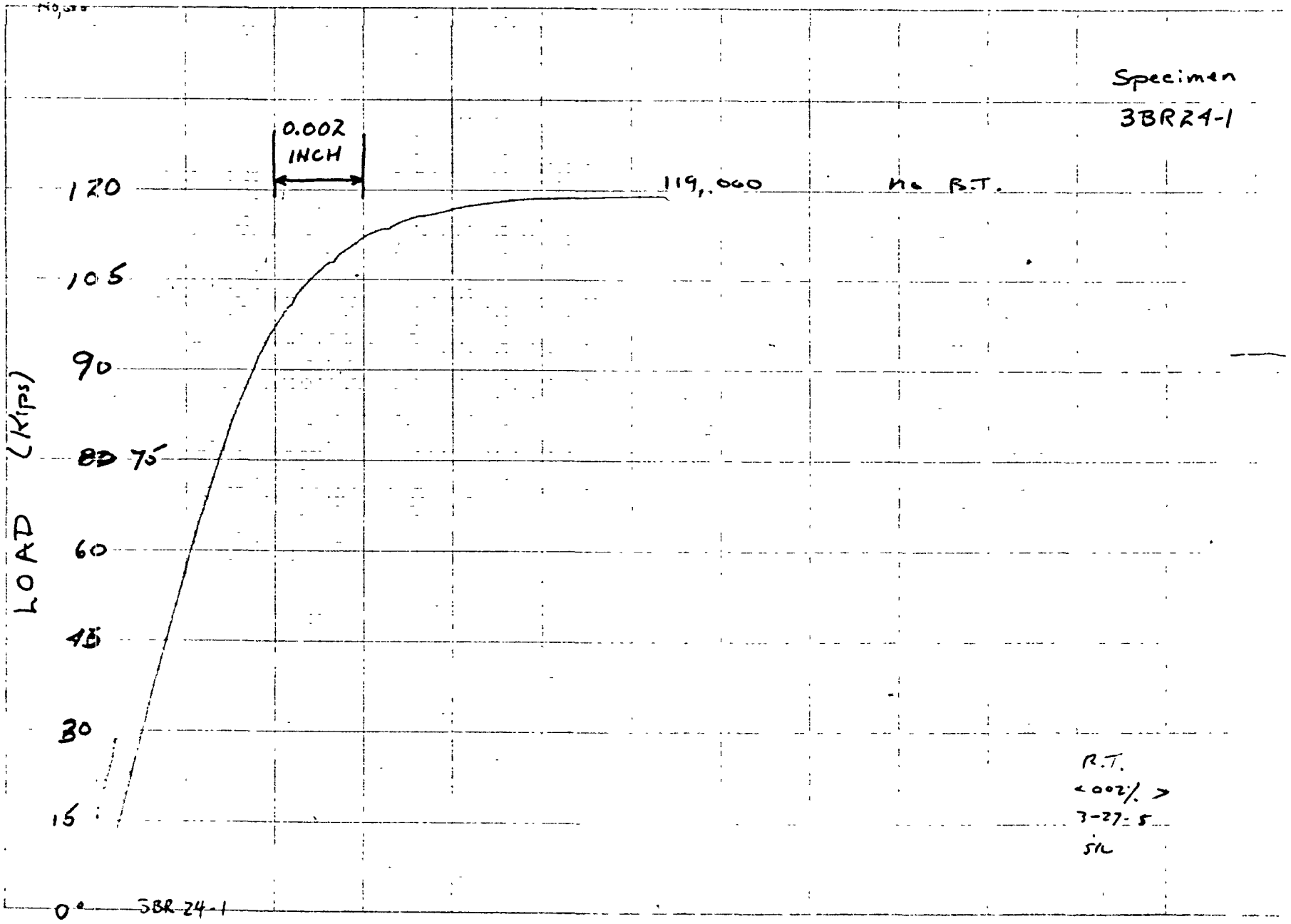
K-E 10 X 10 TO THE INCH • 5 X 10 TO THE INCH
KEUFFEL & ESSER CO. MADE IN U.S.A.
47 0703

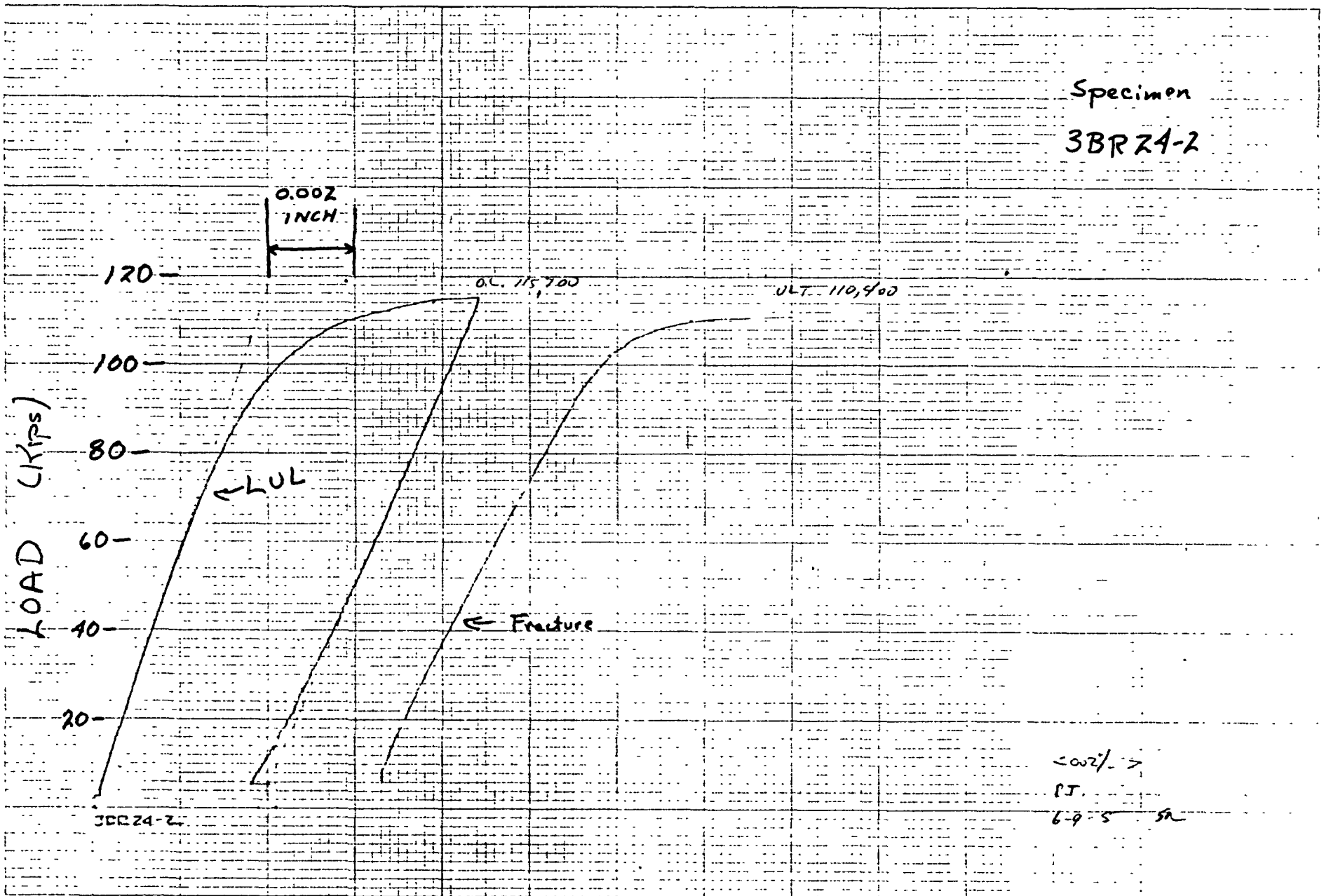

Specimen
2BR24-1
0.002
INCH
LOAD (Kips)
100
80
60
40
20
0.L
100,600
U.L.
0.L 106,500
← L.U.L.
← Fracture
2BR24-1

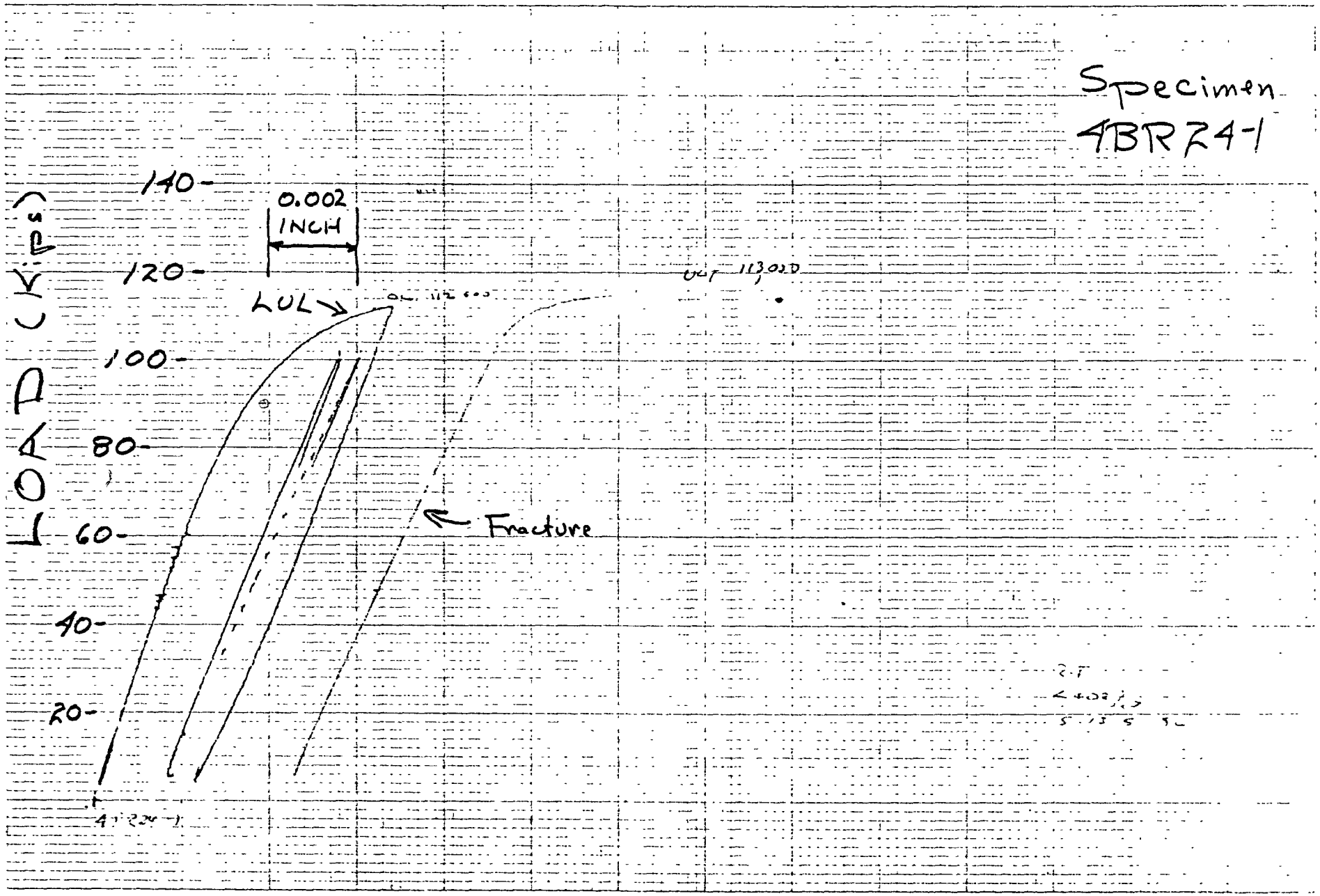

0.002 INCH
Specimen 2BR24-2
120
100
80
60
40
20
LOAD (K lbs)
O.L. 90,800
← LUL
← Fracture
114 20.0
2BR24-2
<.002" >
2-19-5 SK.
R.T.

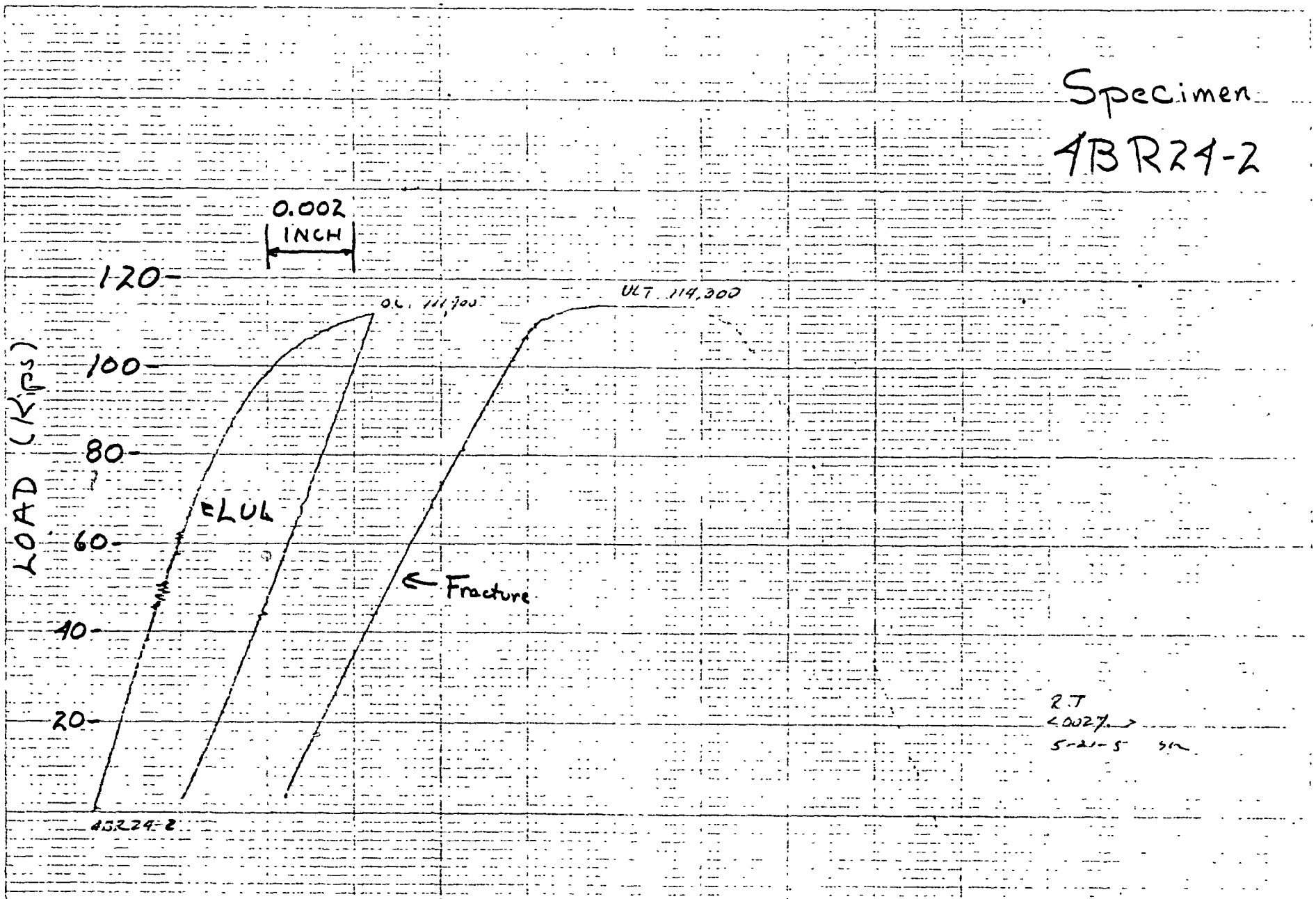

Specimen.
2BR 24-3
0.002 INCH
120
100
80
60
40
20
LOAD (Kips)
ULT 114,000
P.O.L. 91,200
P.O.L. 82,300
ELUL
ELUL
← Fracture
EDL <.002% >
P.T. 2·20-5
2BRZ4-8

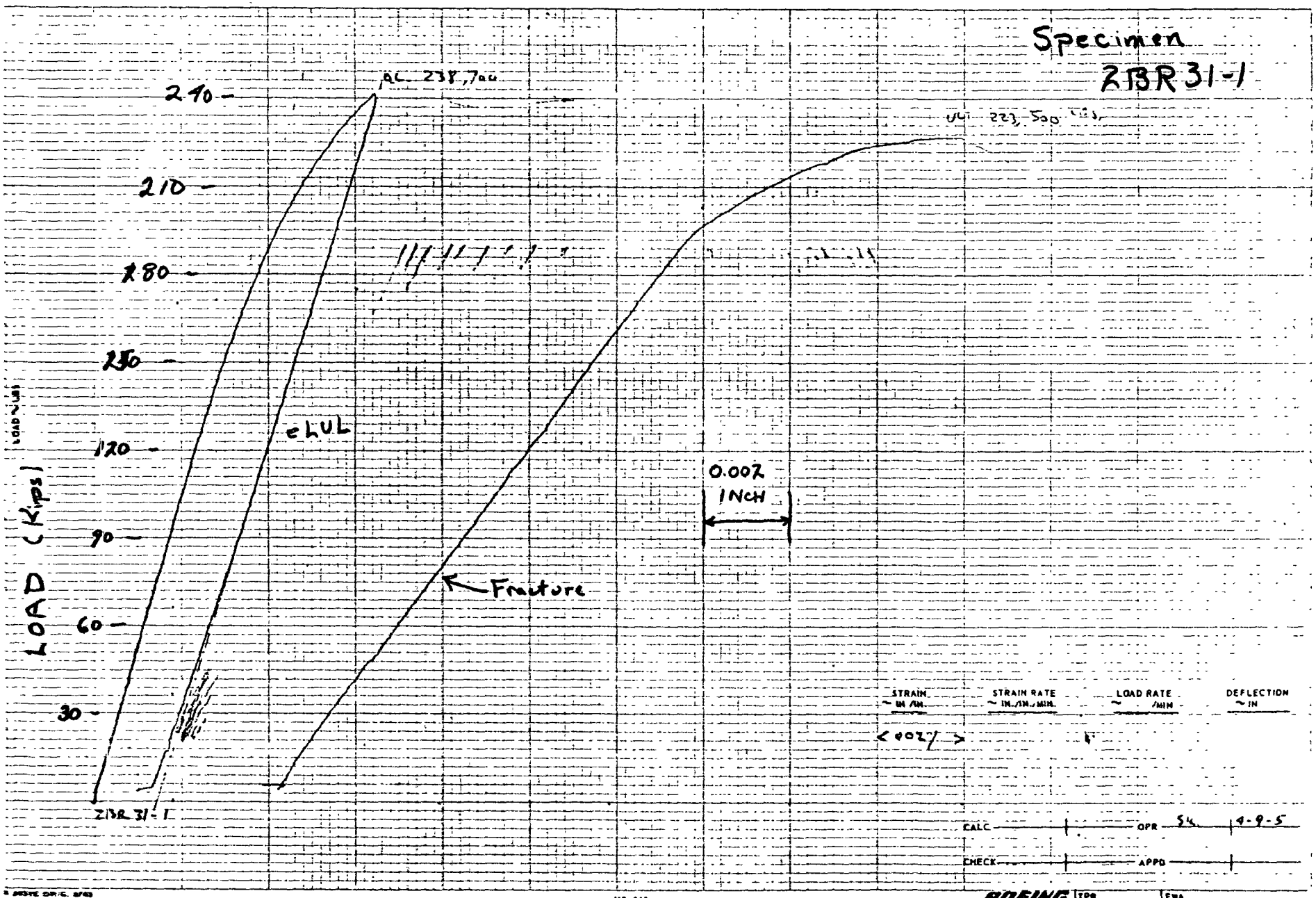

Specimen
ZBR 24-1
0.002
INCH
120
100
80
60
40
20
LOAD (KIPS)
01. 111700
← LUL
DCT 108,400
← Fracture
ZBR24-1
< 002 >
RT
5-8-5 SHL

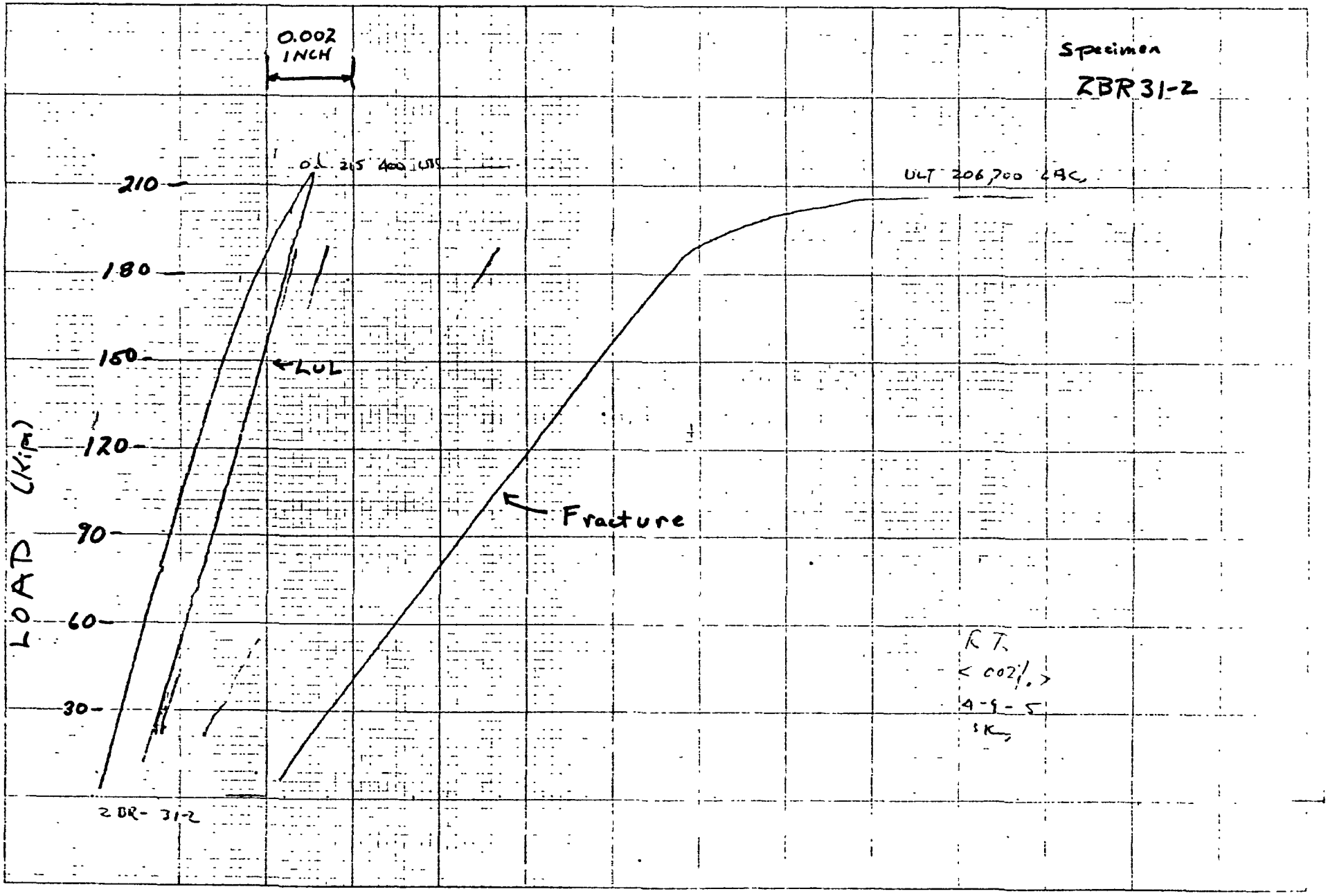

Specimen
3BR24-1
0.002
INCH
119,000 lbs R.T.
120
105
90
75
60
45
30
15
0
LOAD (KIPS)
3BR-24-1
R.T.
<.002"/"
3-27-5
SIL

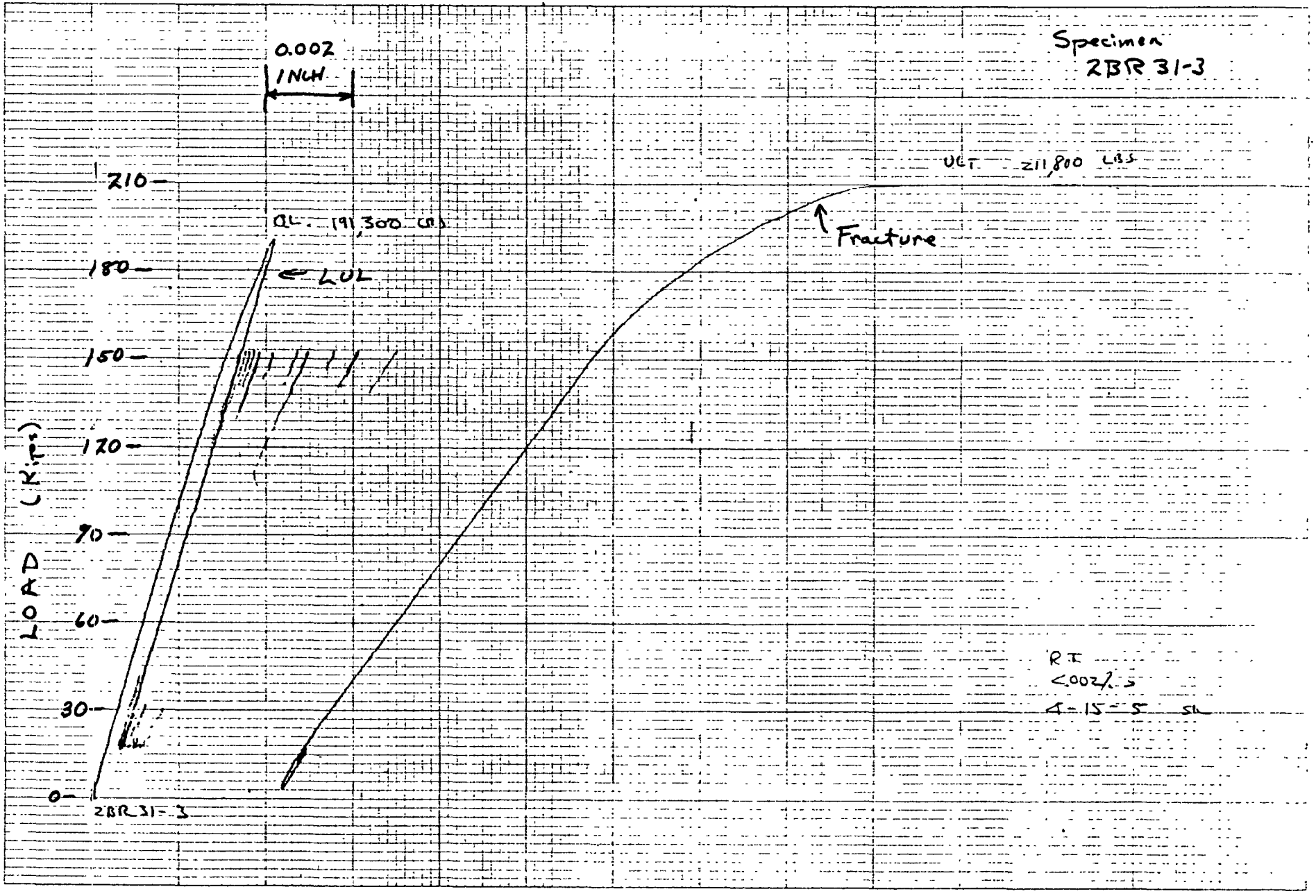

Specimen
3BRZ4-2
0.002
INCH
120
100
80
60
40
20
LOAD (Kips)
0.L. 115,700
ULT. 110,400
←LUL
← Fracture
3BRZ4-2
<002/.>
P.J.
6-9-5

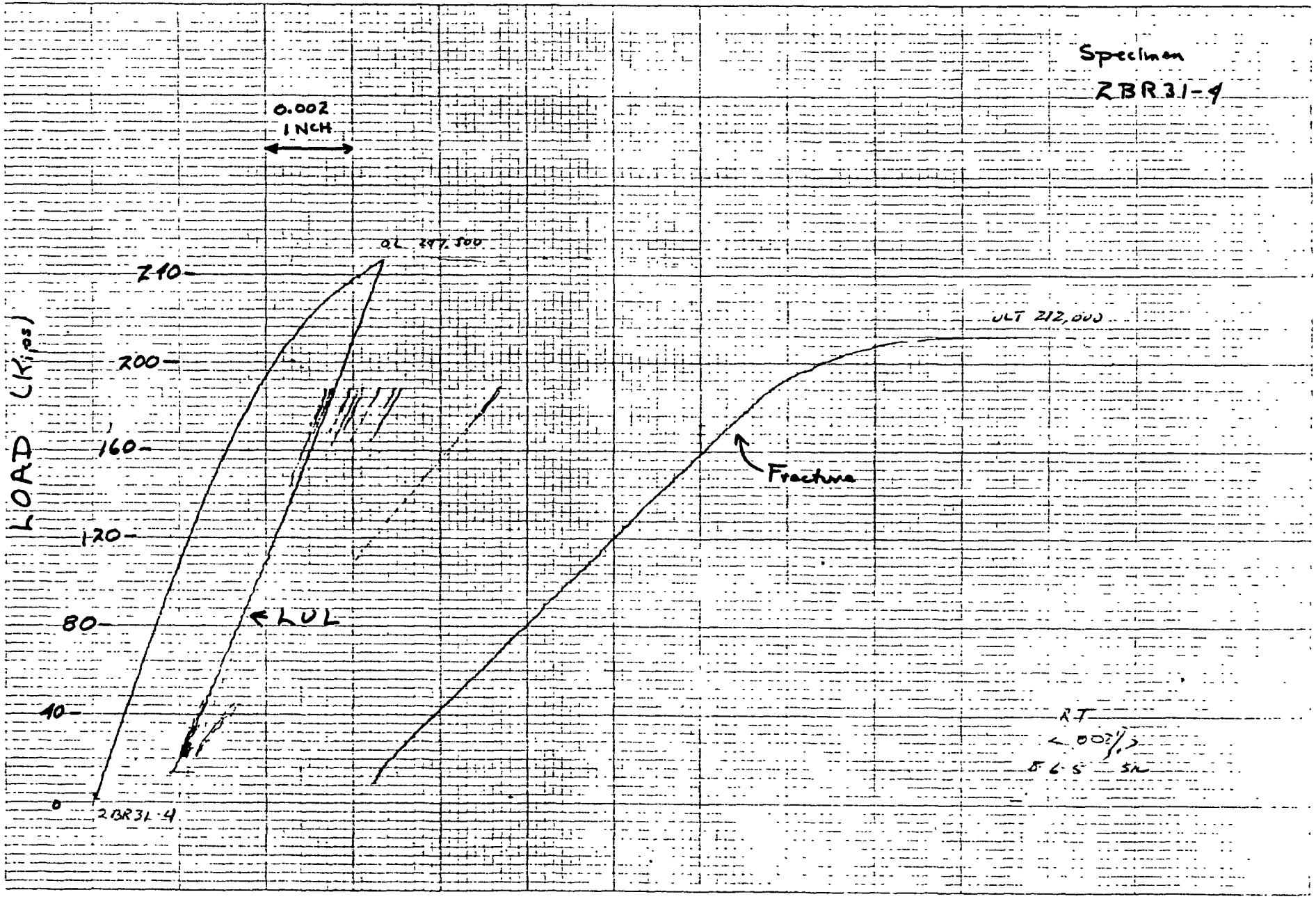

Specimen
4BR24-1
LOAD (KIPS)
140
120
100
80
60
40
20
0.002
INCH
LUL
Fracture

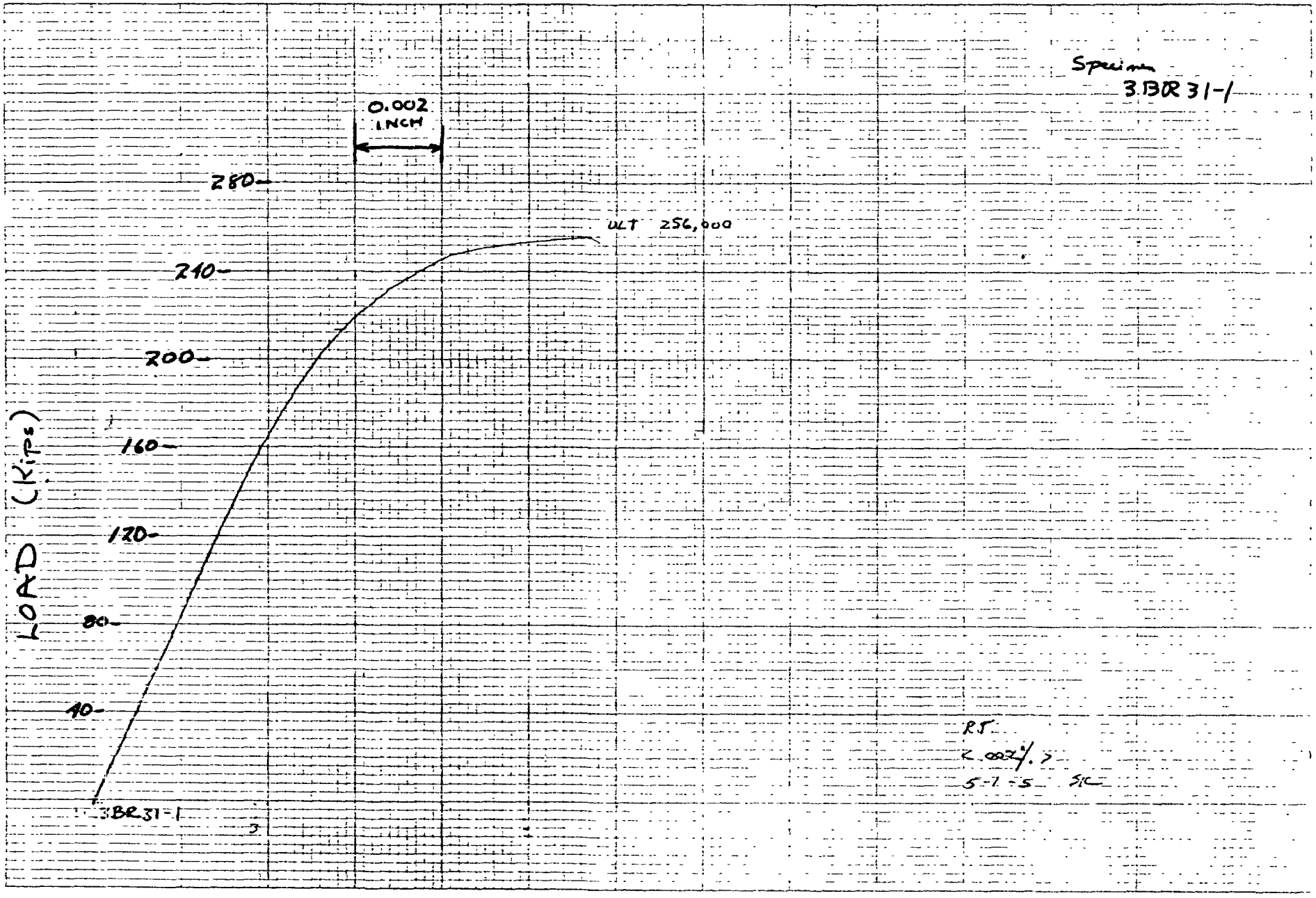

Specimen
4BR24-2
0.002
INCH
120
100
80
60
40
20
LOAD (KIPS)
O.L. 111,300
ULT. 114,300
=LUL
← Fracture
R.T
<.002
5-21-5
4BR24-2

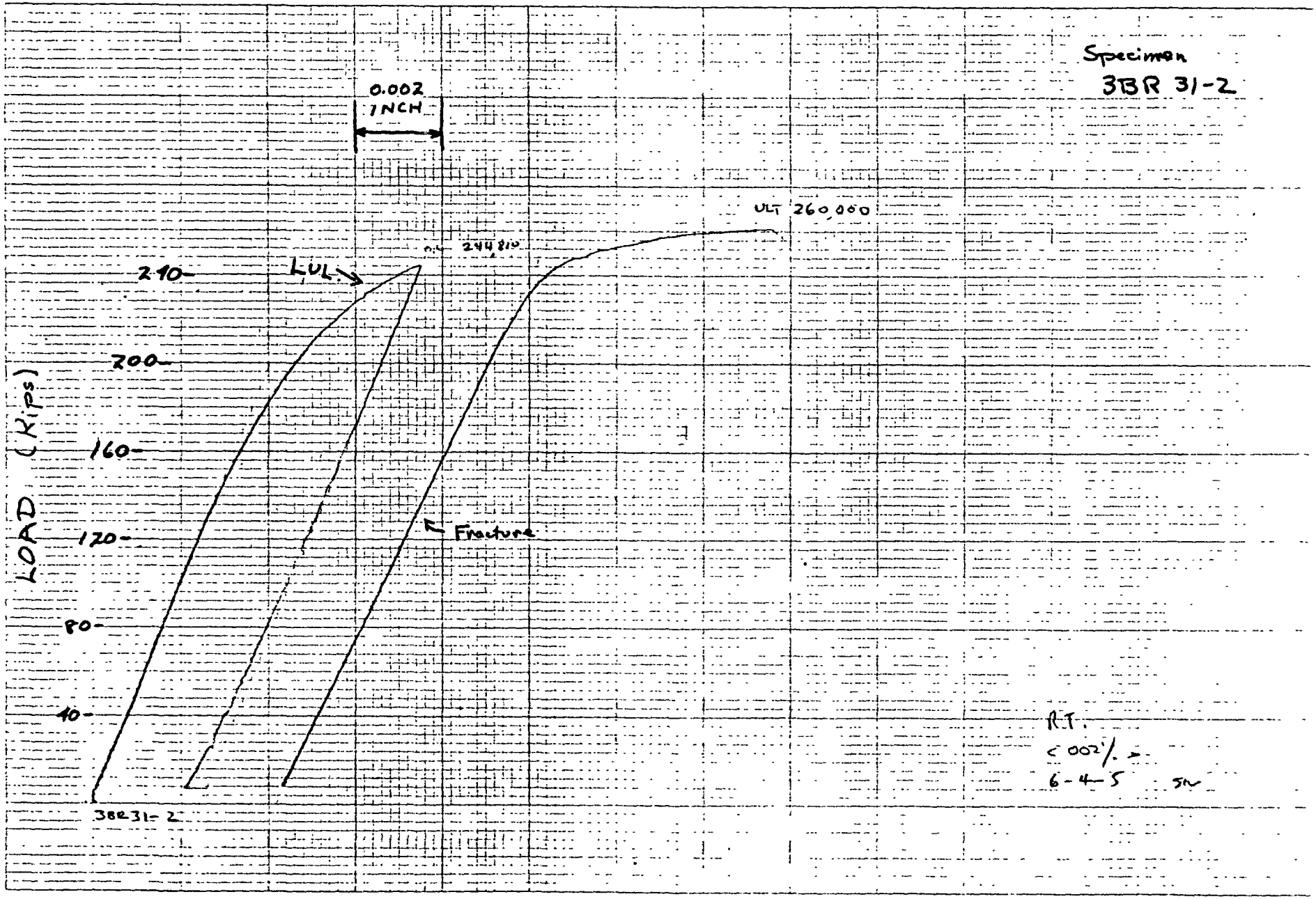

Specimen
2TBR31-1
AL 238,700
UU 223,500 (1)
240
210
180
150
120
90
60
30
LOAD (Kips)
eLUL
0.002
INCH
Fracture
2TBR31-1
STRAIN ~ IN/IN.
STRAIN RATE ~ IN./IN./MIN.
LOAD RATE ~ /MIN
DEFLECTION ~ IN
<.002"/>
CALC
OPR
SH
9-9-5
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF

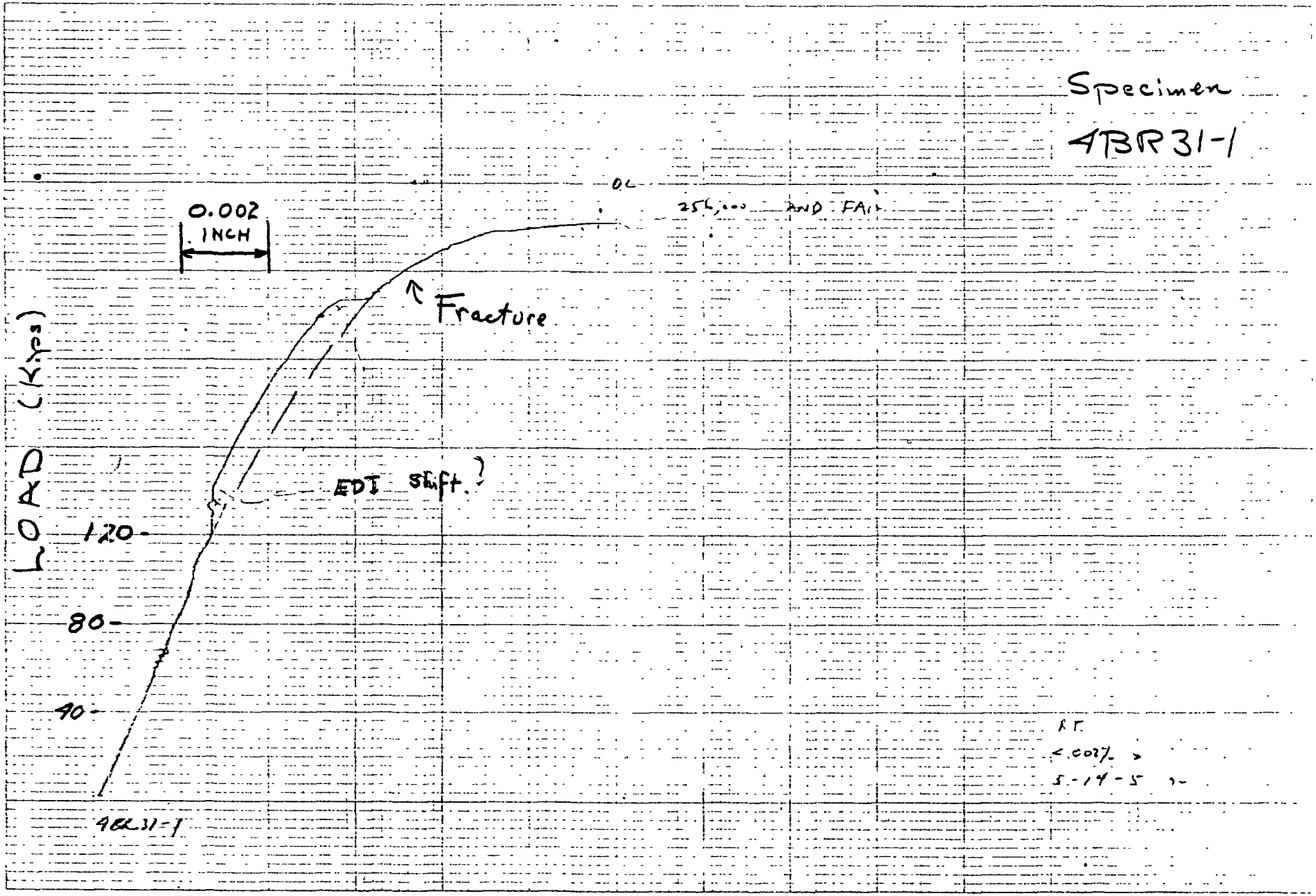

0.002 INCH
Specimen
ZBR31-2
O.L. 215 400 LBS
ULT 206,700 LBS
210
180
150
120
90
60
30
LOAD (Kips)
←LUL
Fracture
R.T.
< 002 >
4-9-5
SK
ZBR-31-2


Specimen
2BR 31-3
0.002
INCH
LOAD (K.I.P.S)
210
180
150
120
90
60
30
0
QL. 191,300 LBS
← LOL
UCT 211,800 LBS
Fracture
RT
<.002/.5
4-15-5
2BR 31-3

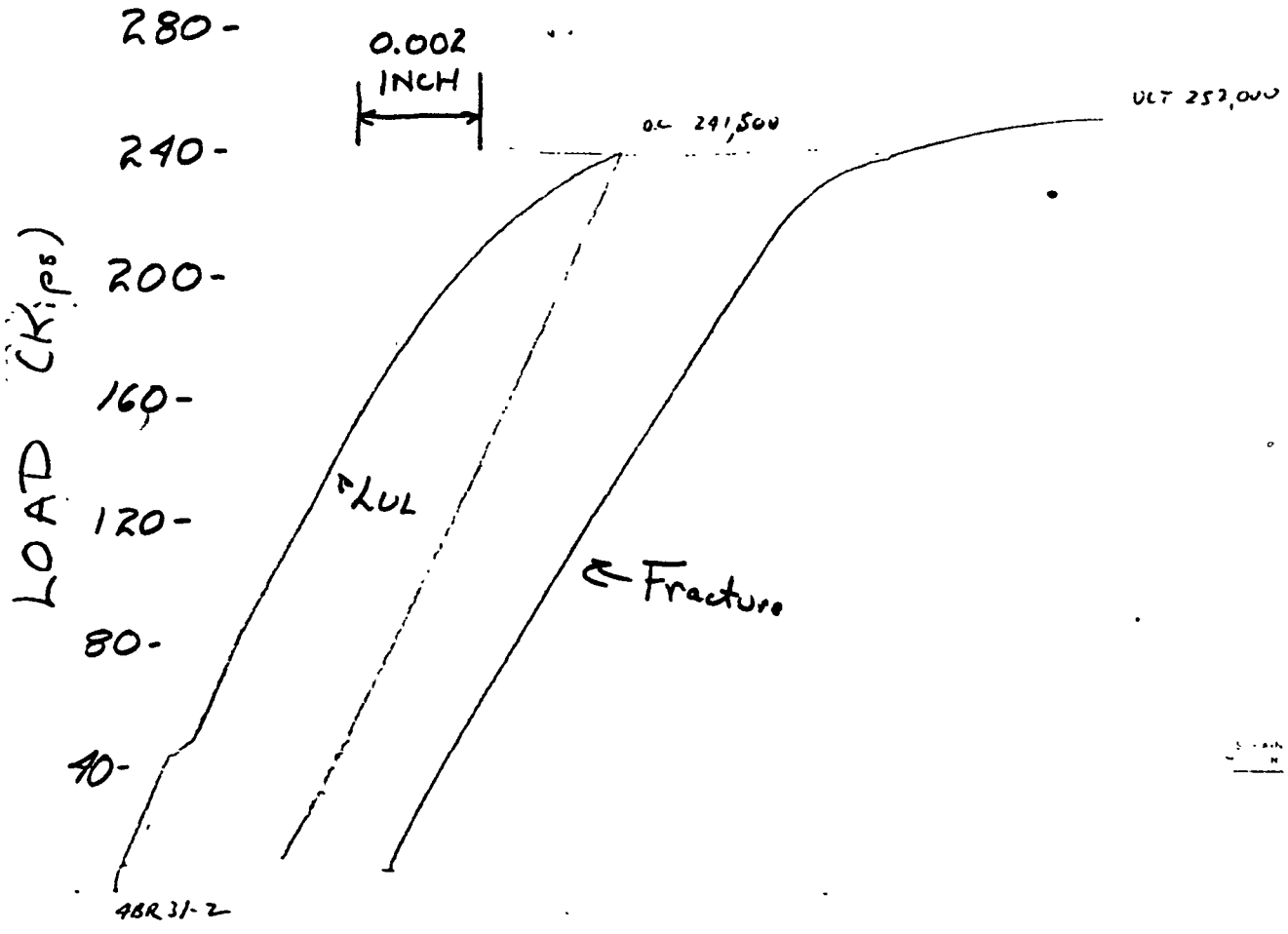

Specimen
ZBR31-4
0.002
INCH
OL 297,500
ULT 212,000
Fracture
LOAD (Kips)
240
200
160
120
80
40
0
ZBR31-4
LUL
RT
< 00?/>
56.5 SN

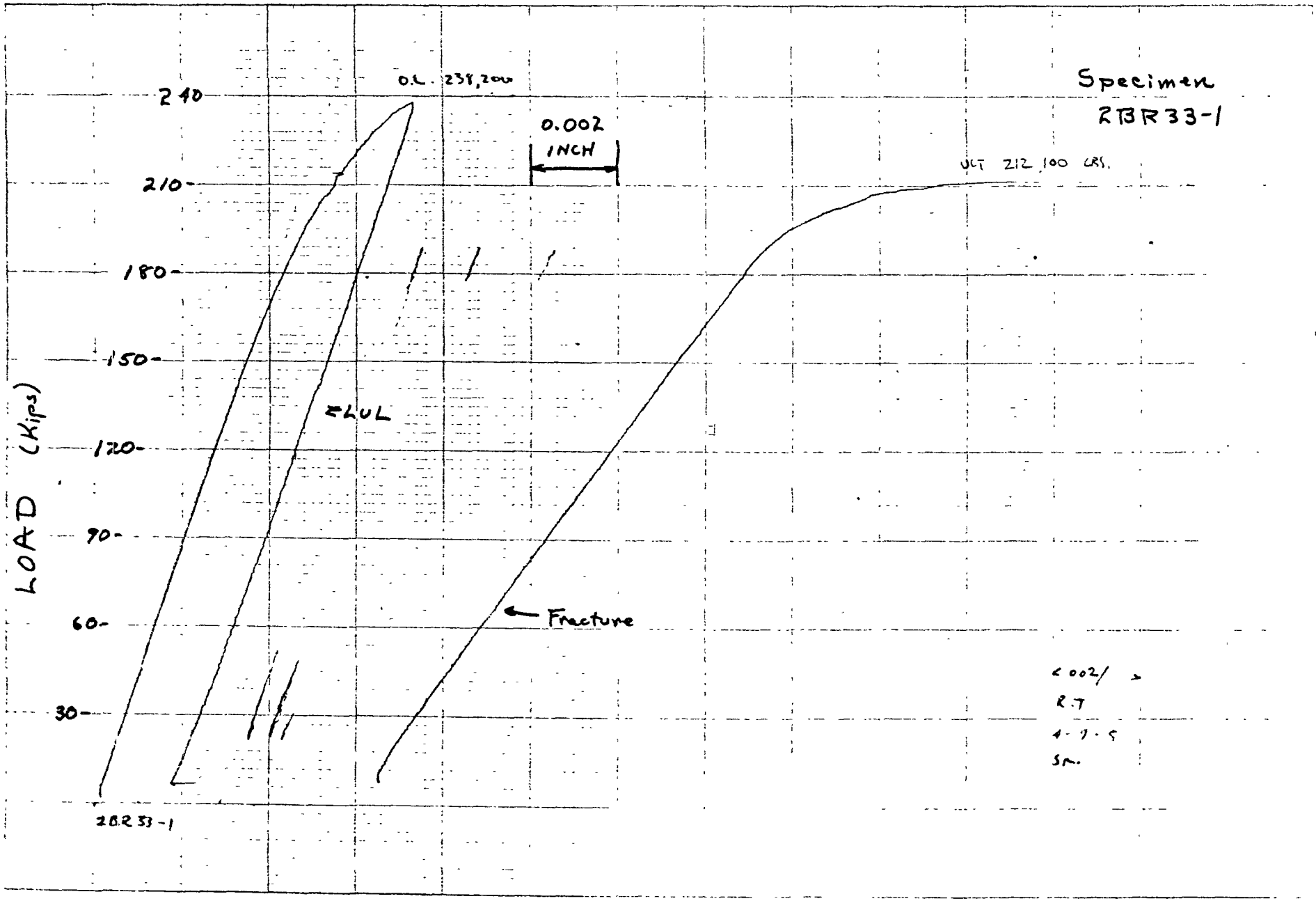

Specimen
3BR31-1
0.002
INCH
ULT 256,000
LOAD (KIPS)
280
240
200
160
120
80
40
3BR31-1
RT
K.002%
5-1-5 SC

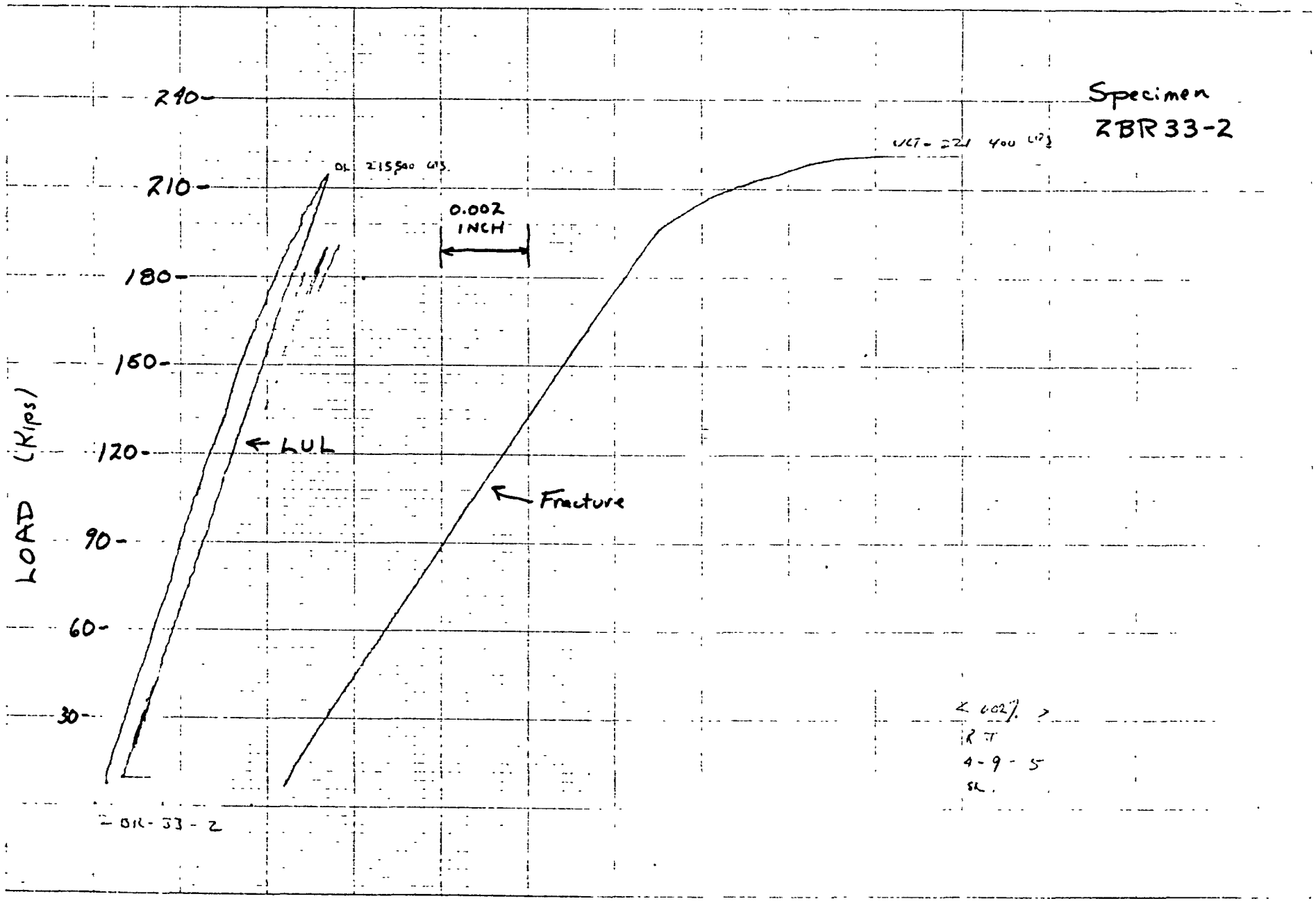

Specimen
3BR 31-2
0.002
INCH
ULT 260,000
244,810
LOAD (Kips)
210
200
160
120
80
40
LUL
Fracture
3BR31-2
R.T.
< 002 /. >
6-4-5

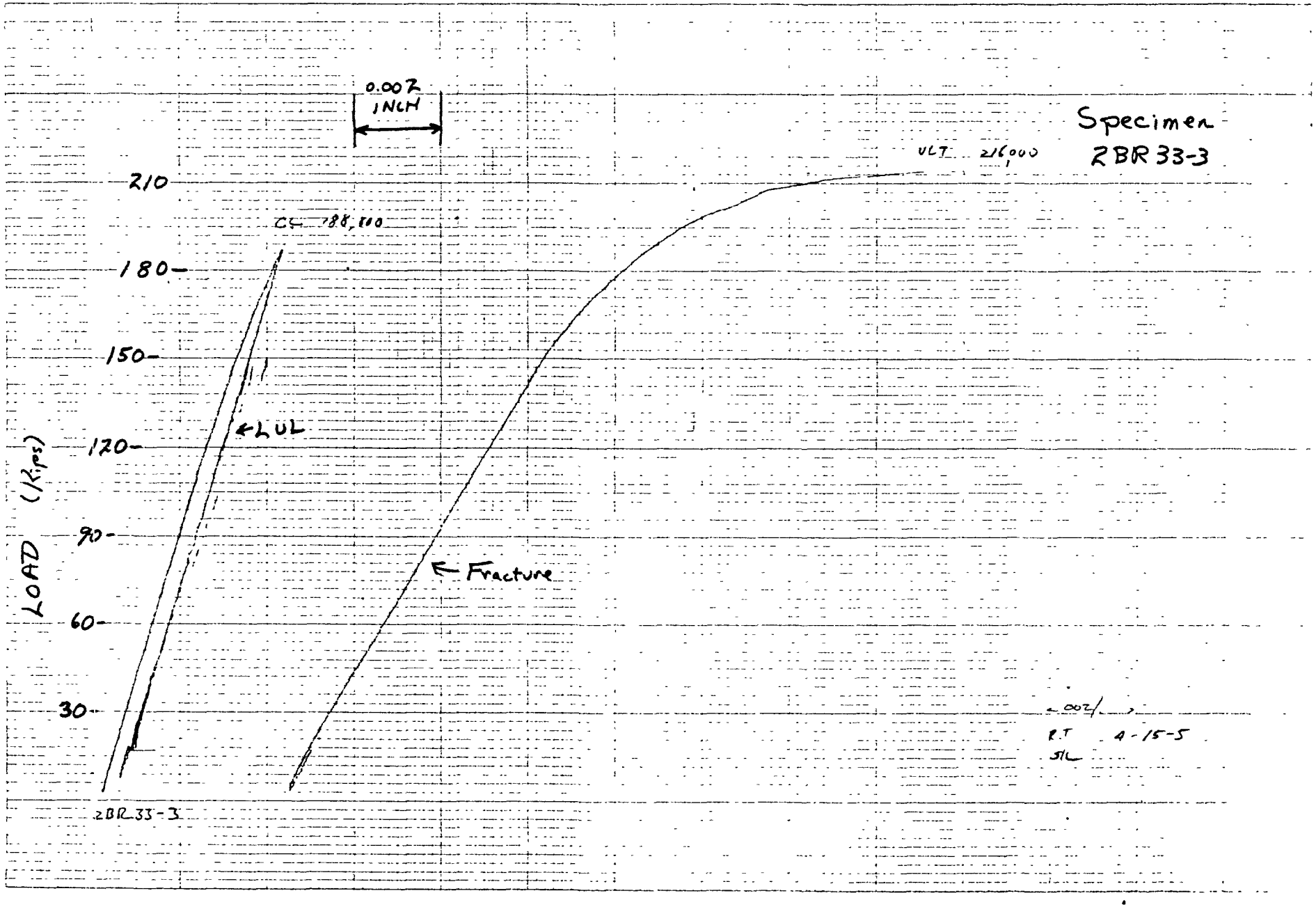

Specimen
4BR31-1
0.002
INCH
↑ Fracture
EDT shift.?
LOAD (Kips)
120
80
40
4BR31-1
RT
<.003"
5-14-5

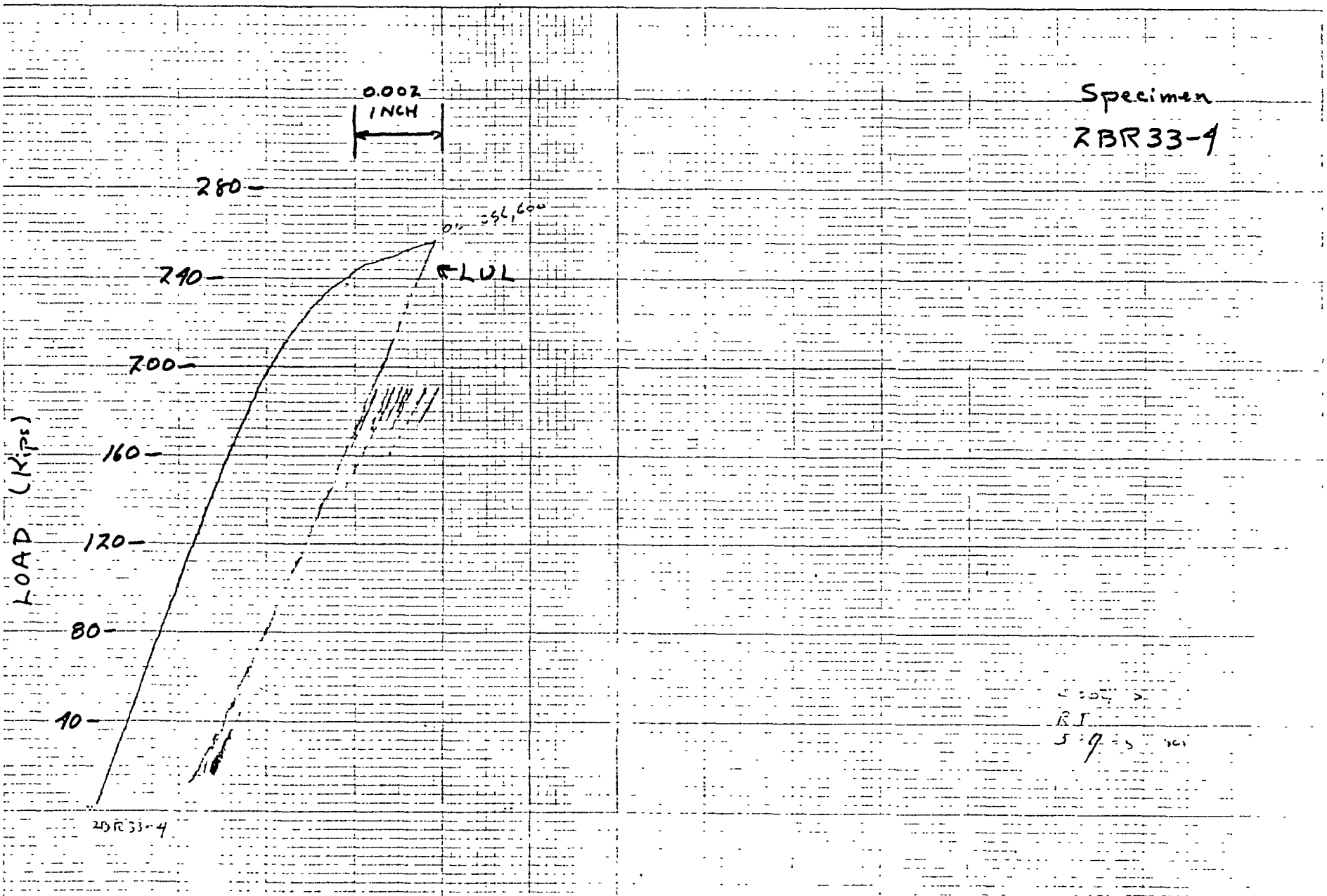
Specimen
4BR 31-2

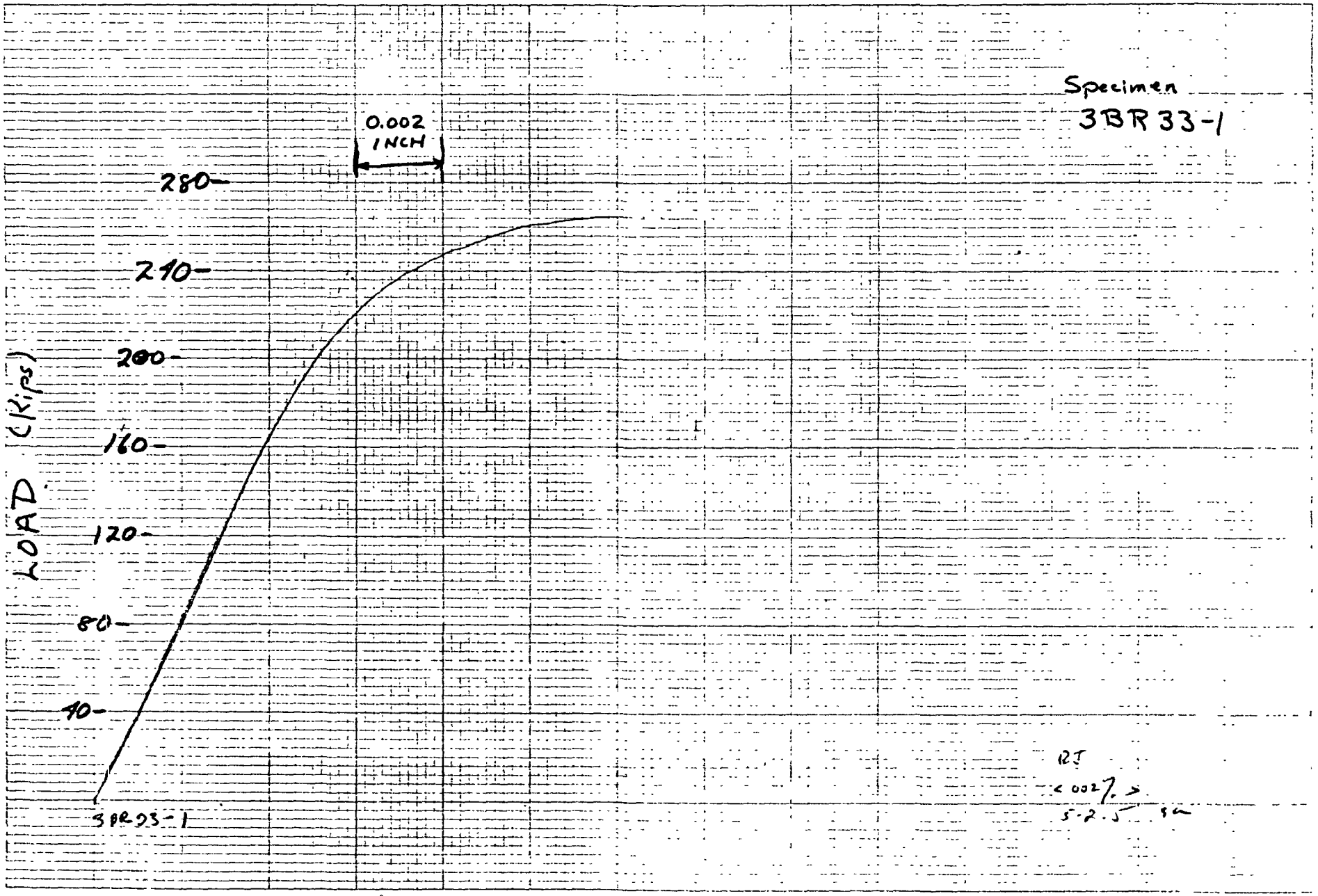


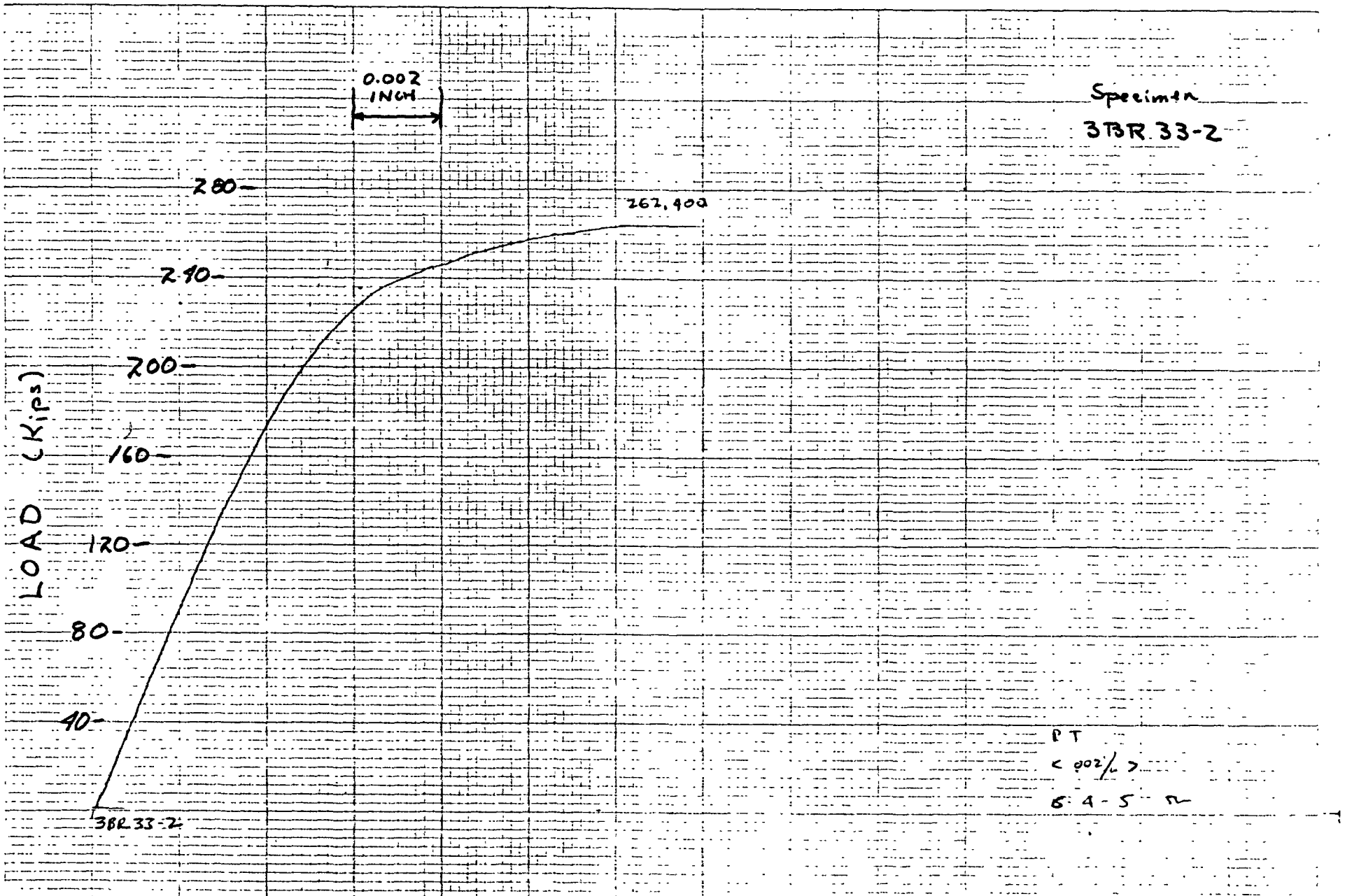

Specimen
2B3R33-1
0.002
INCH
0.L. 238,200
ULT 212,100 LBS.
240
210
180
150
120
90
60
30
LOAD (Kips)
2B2S3-1
Fracture
< 002/ >
R.T
4-7-5
Sm.

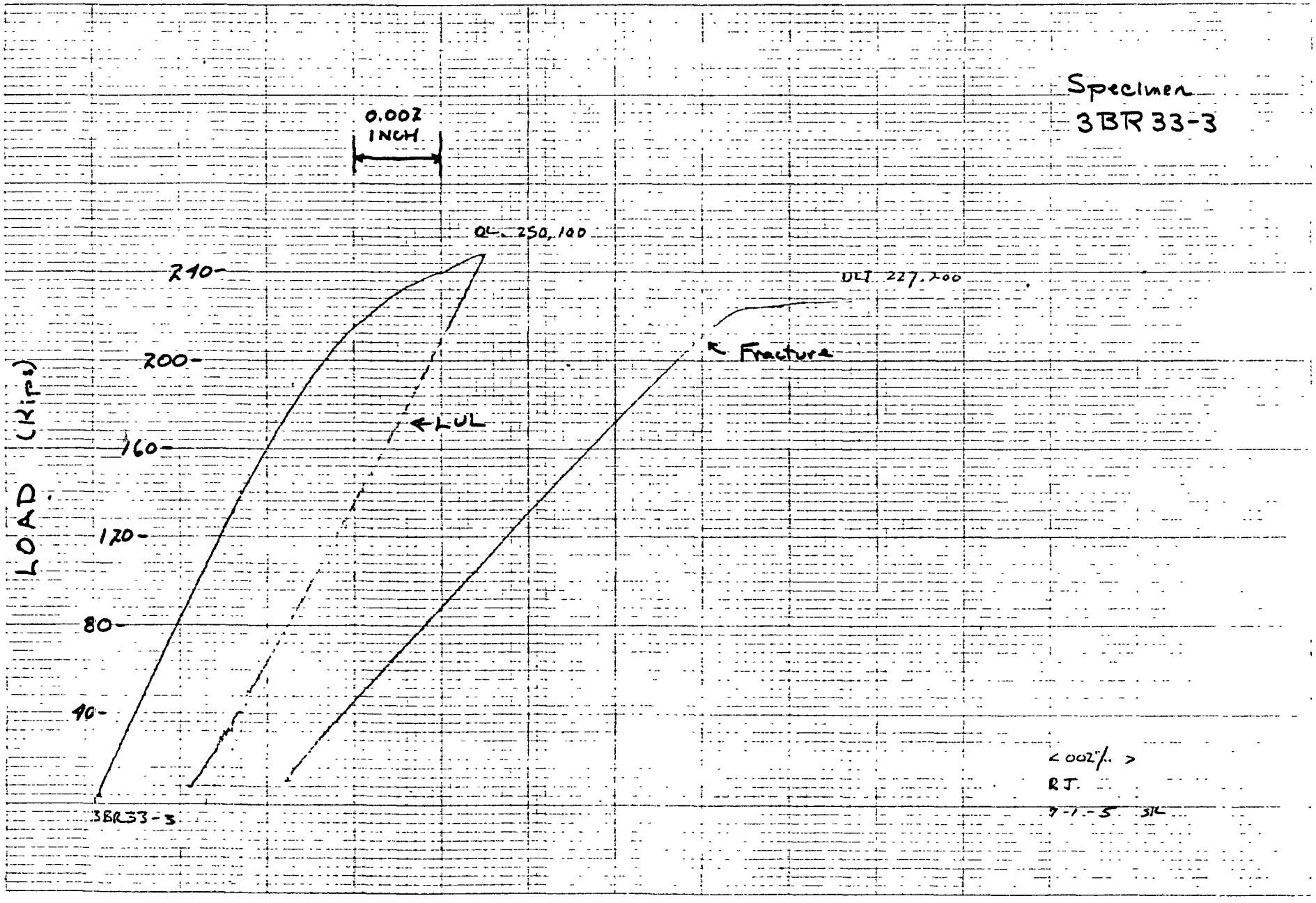

Specimen
ZBR33-2
240
210
180
150
120
90
60
30
LOAD (Kips)
DL 215,500 lbs.
UCT - 224 400 lbs
0.002
INCH
← LUL
← Fracture
< .002" >
R T
4-9-5
SL.
ZBR-33-2

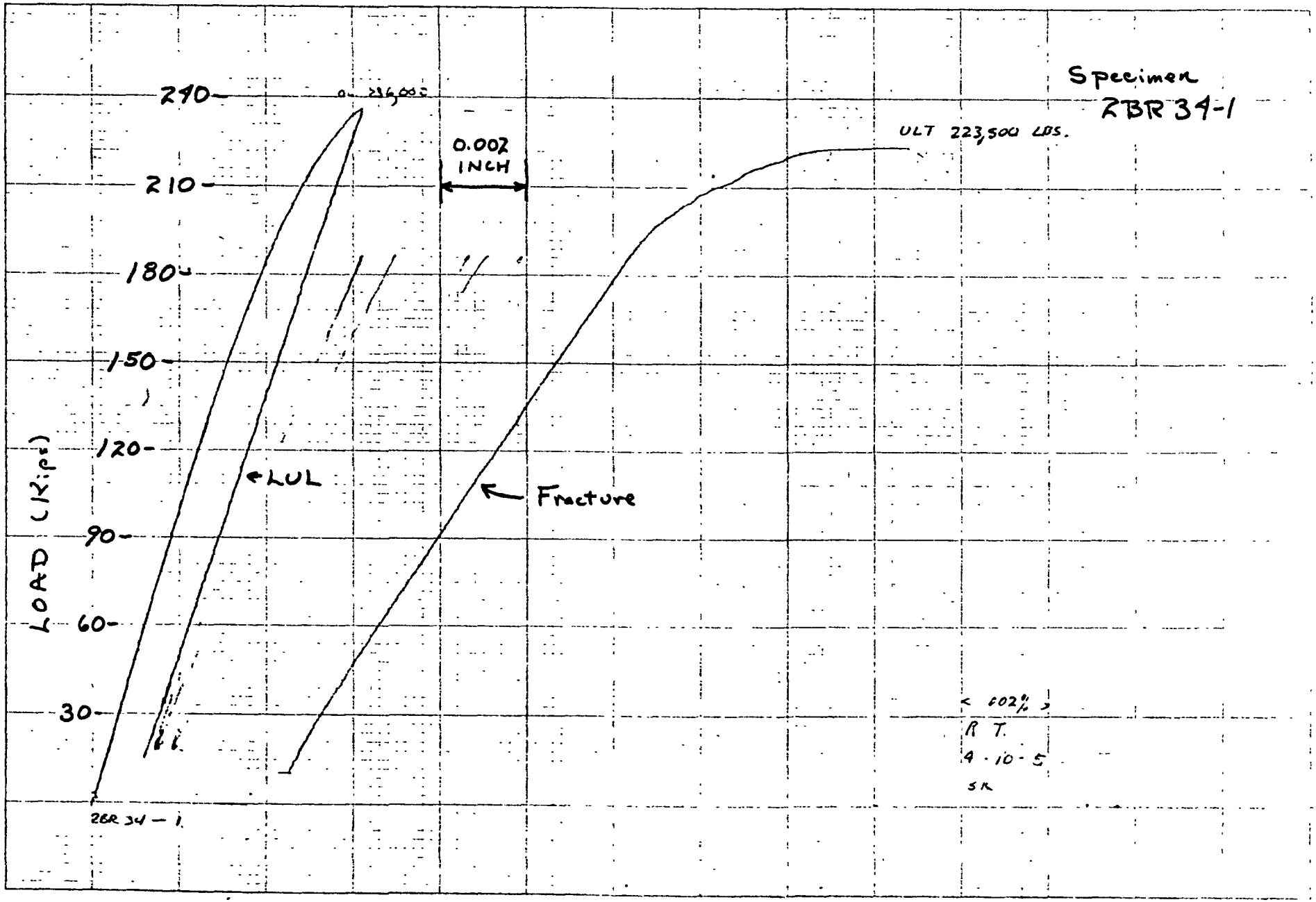

0.002 INCH
Specimen
2BR33-3
ULT 216,000
210
180
150
120
90
60
30
LOAD (Kips)
CL 188,000
← LUL
← Fracture
2BR33-3
.002/
R.T 4-15-5
STL

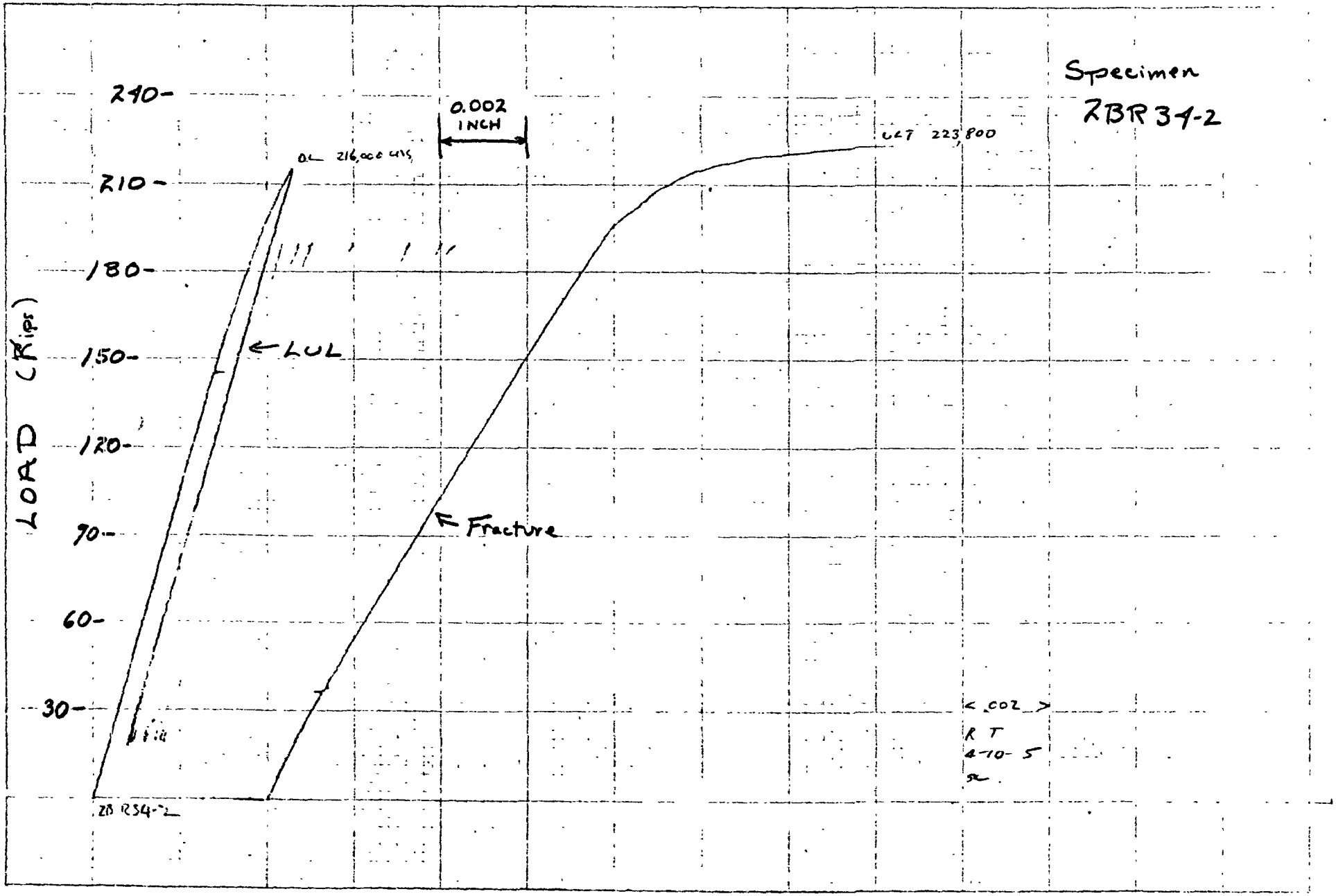

0.002
INCH
Specimen
2BR33-4
280
240
200
160
120
80
40
LOAD (KIPS)
LUL
2BR33-4

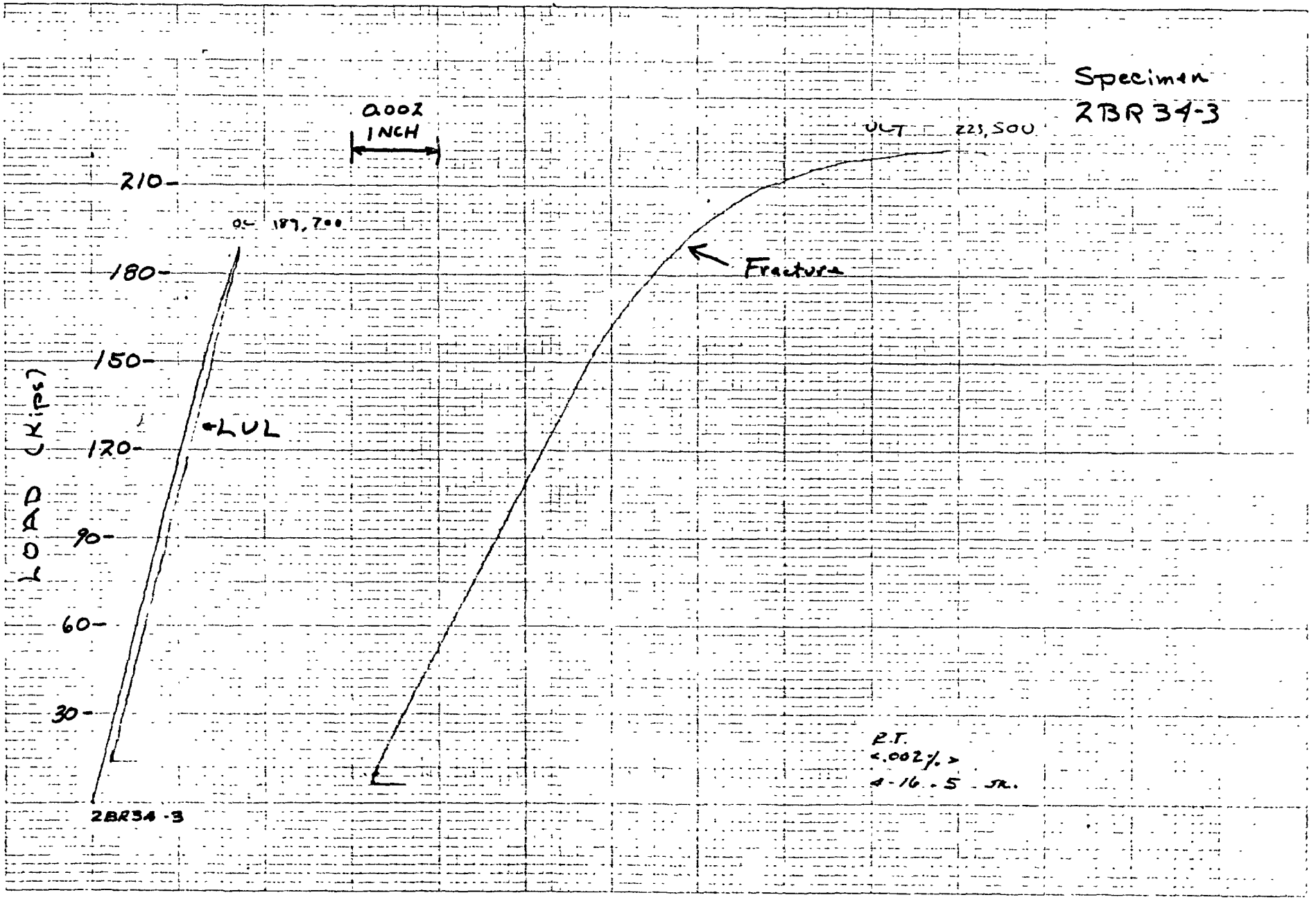

Specimen
3BR33-1
0.002
INCH
280
240
200
160
120
80
40
LOAD (Kips)
3BR33-1
RT
< 002 >
5-2-5


0.002 INCH
Specimen
3BR33-2
262,400
280
240
200
160
120
80
40
LOAD (Kips)
3BR33-2
PT
< 002" >
6·4-5

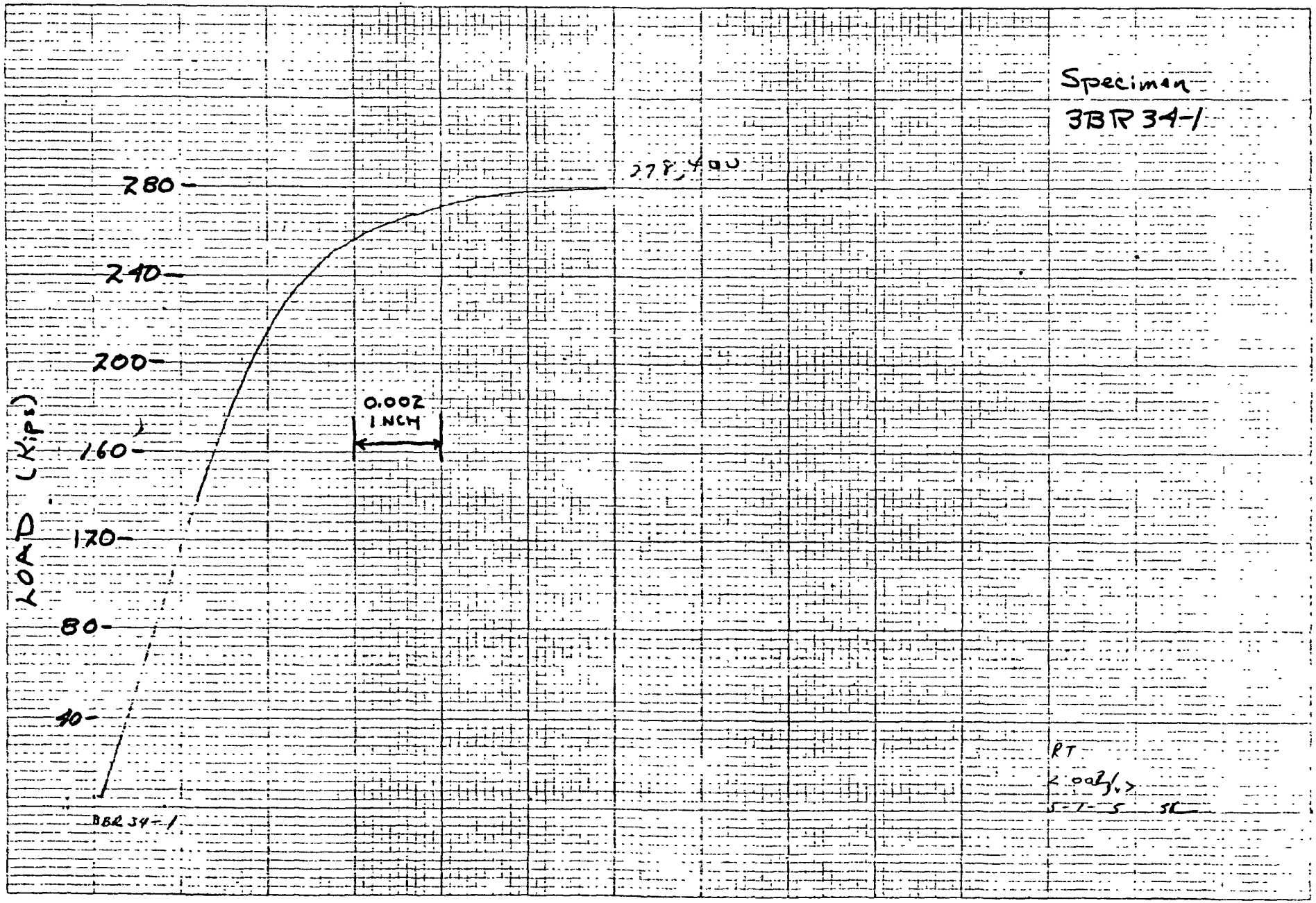

Specimen
3BR33-3
0.002
INCH
QL 250,100
ULT 227,200
Fracture
←LUL
240
200
160
120
80
40
LOAD (Kips)
3BR33-3
< 002"/.. >
R.T.

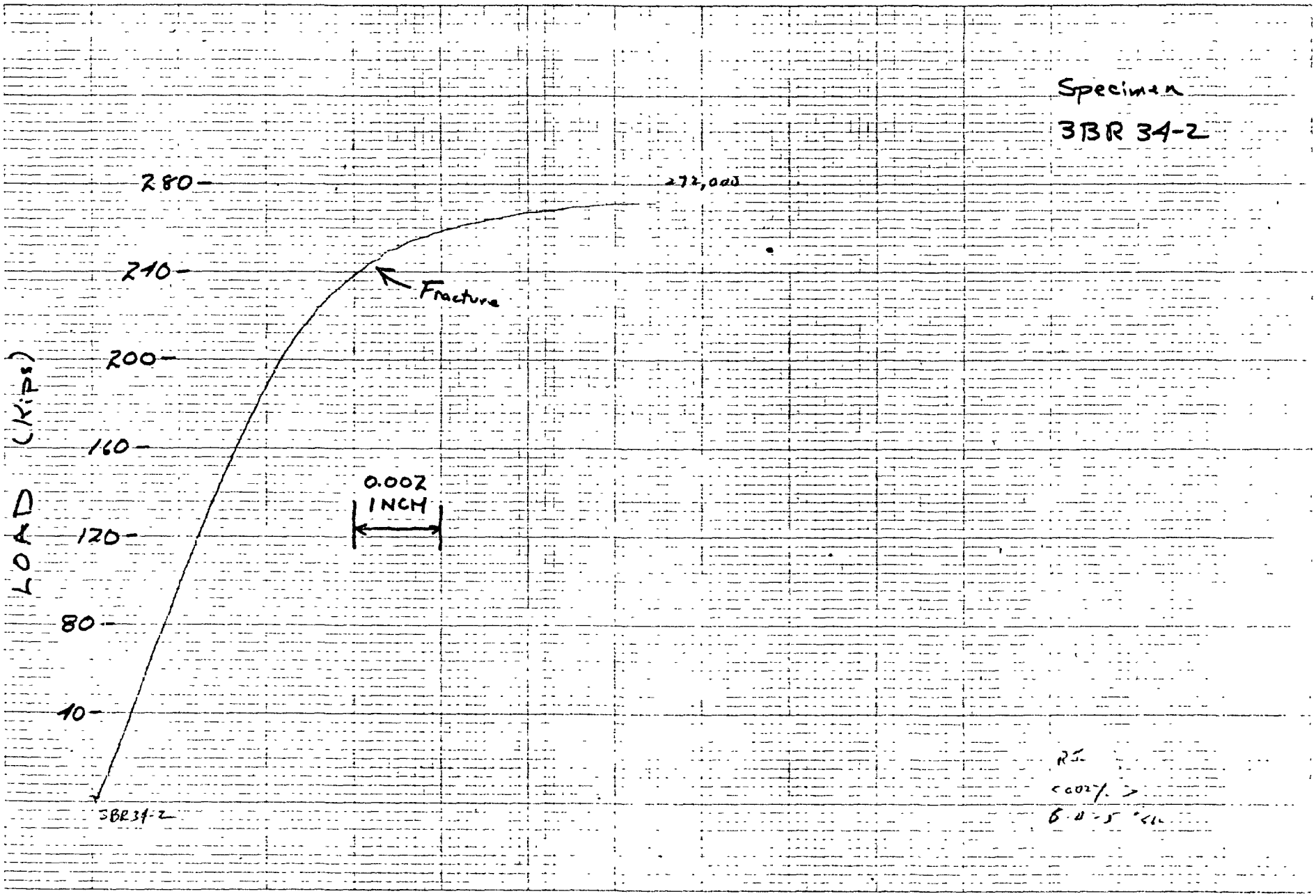

Specimen
ZBR 34-1
ULT 223,500 LBS.
0.002
INCH
240
210
180
150
120
90
60
30
LOAD (Kips)
LUL
Fracture
ZBR 34 – 1
< 002% >
R T.
4 · 10 - 5
SK

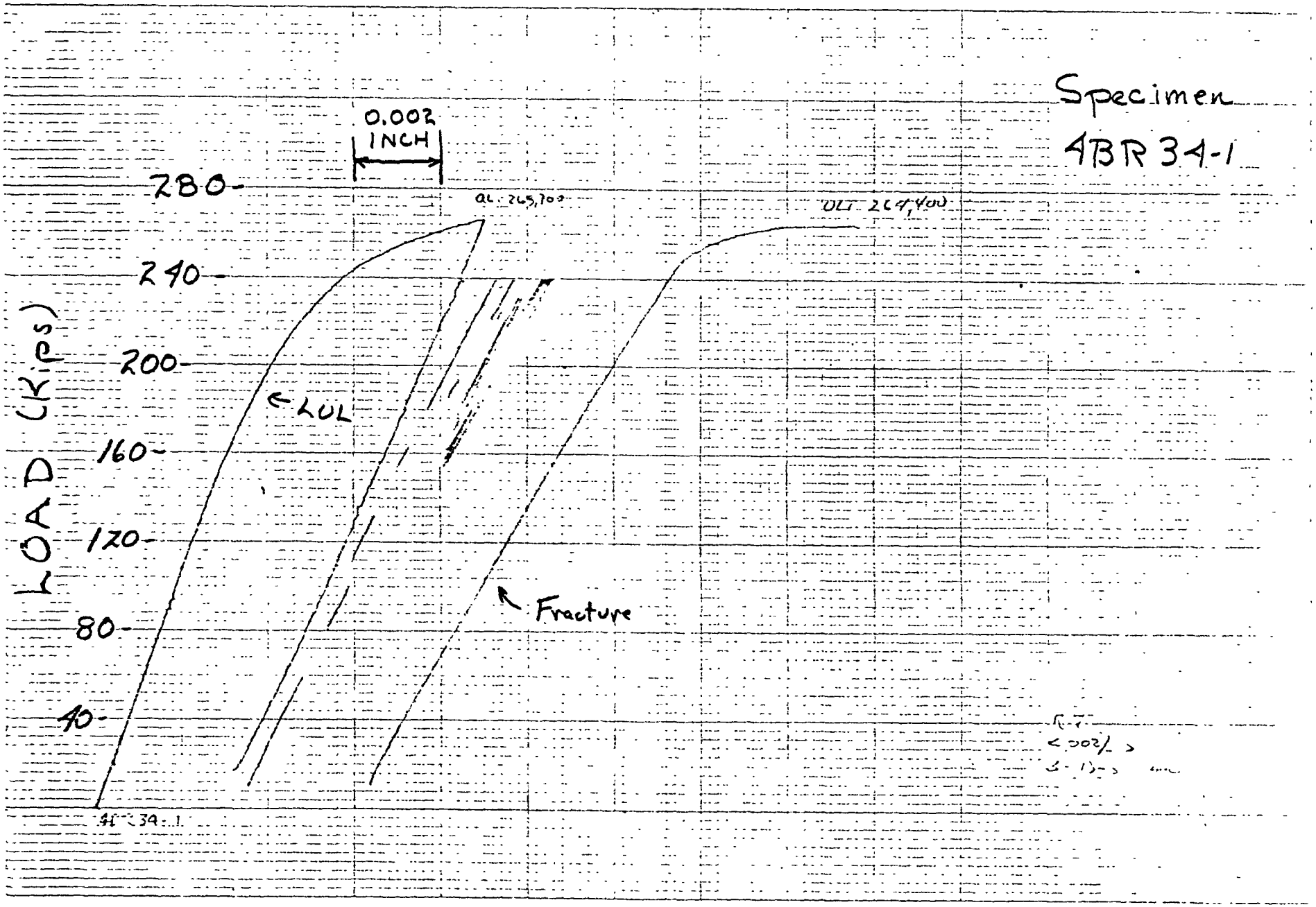

Specimen
ZBR34-2
240
210
180
150
120
90
60
30
LOAD (Kips)
0.002
INCH
OL 216,000 LBS
UCT 223,800
← LUL
← Fracture
< CO2 >
R T
4-10-5
ZB R34-2

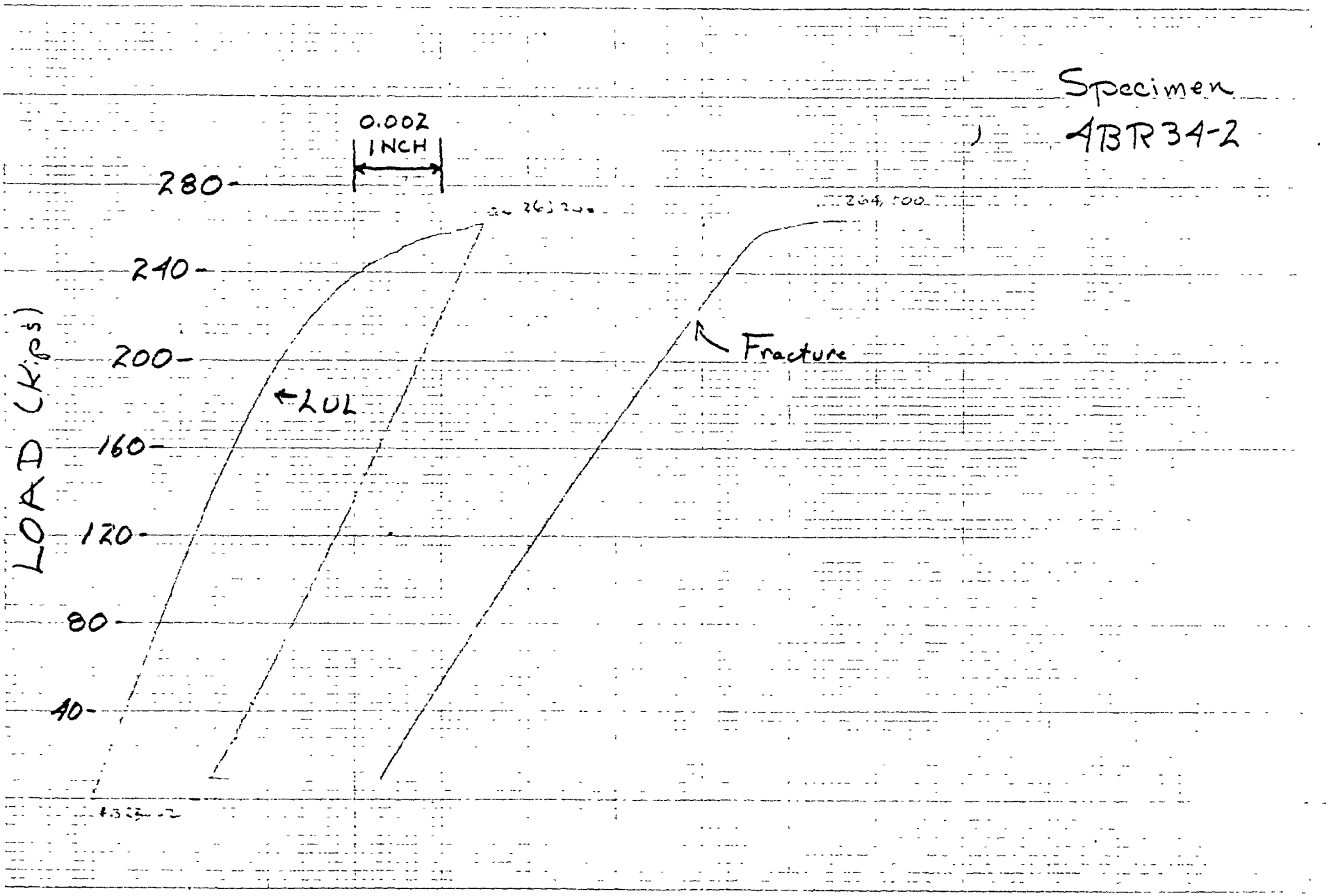

Specimen
2BR34-3
.002
INCH
ULT 223,500
210
180
150
120
90
60
30
LOAD (Kips)
187,700
Fracture
P.T.
<.002%>
4-16-5 Jr.
2BR34-3

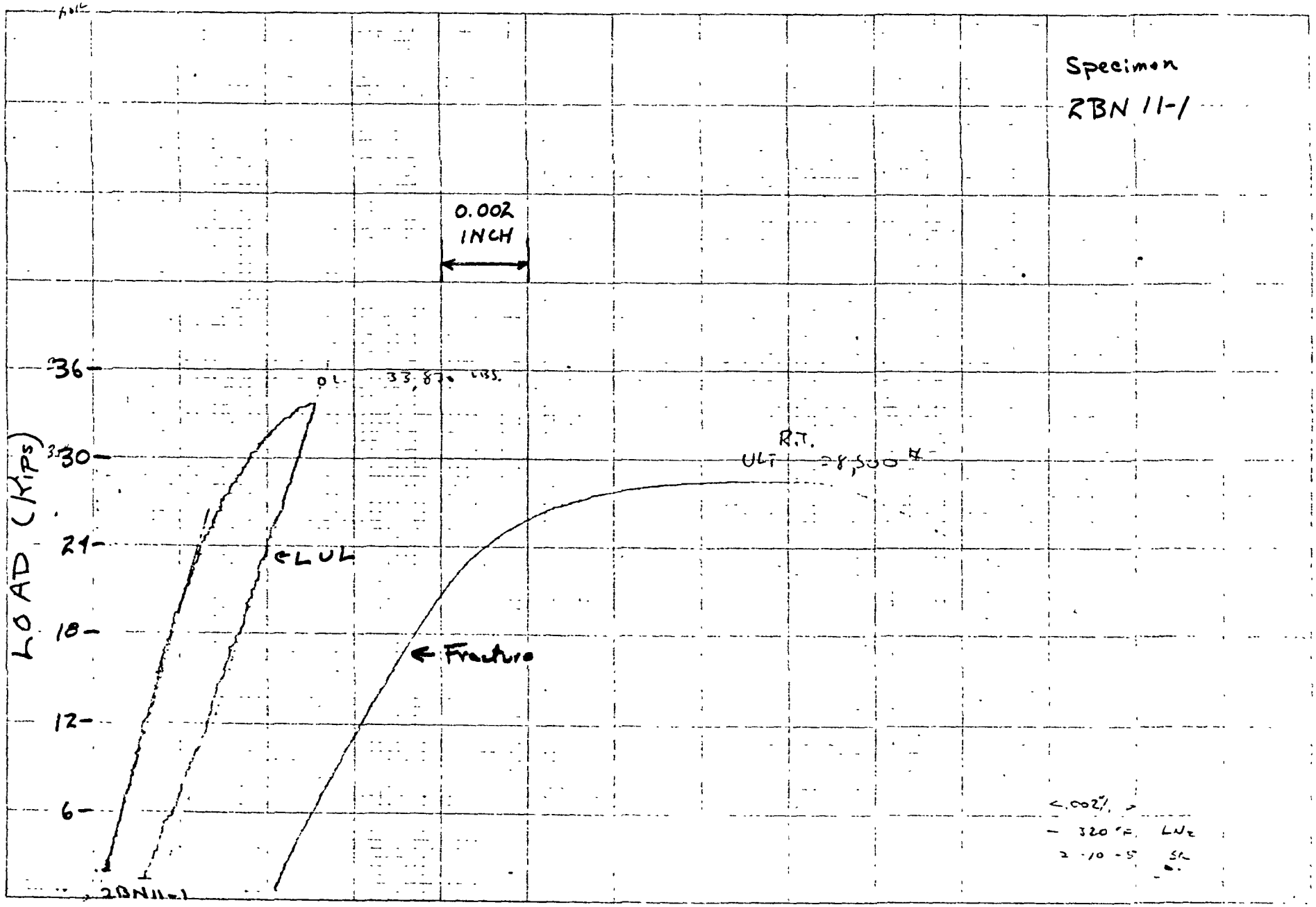
Specimen
ZTBR34-4
0.002
INCH
K Fracture
K LUL
LOAD (K, ksi√in)
280
240
200
160
120
80
40
R.T.
5-7-5 SHL

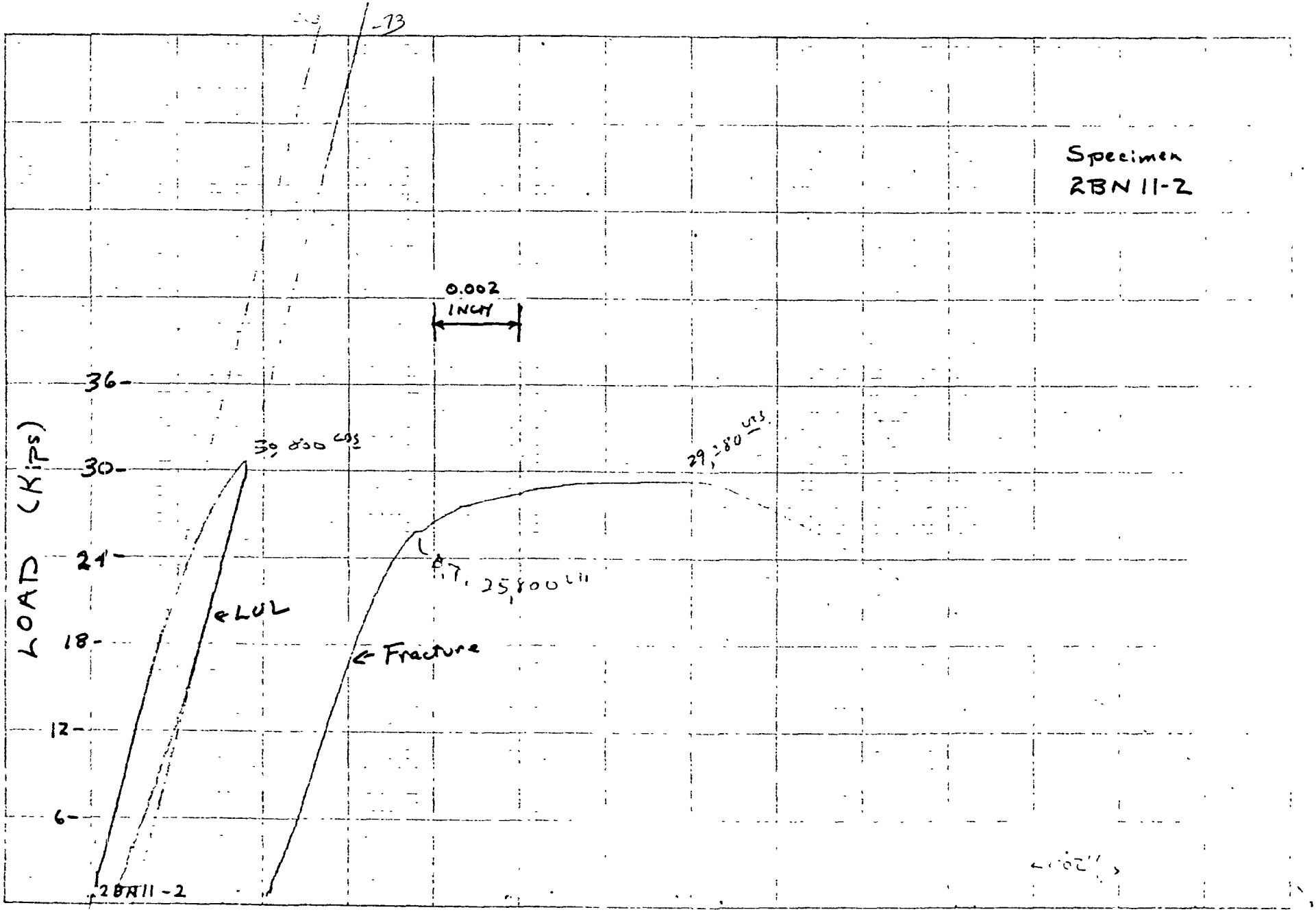

Specimen
3BR34-1
278 kips
280
240
200
160
120
80
40
LOAD (KIPS)
0.002
INCH
BBR 34-1
RT

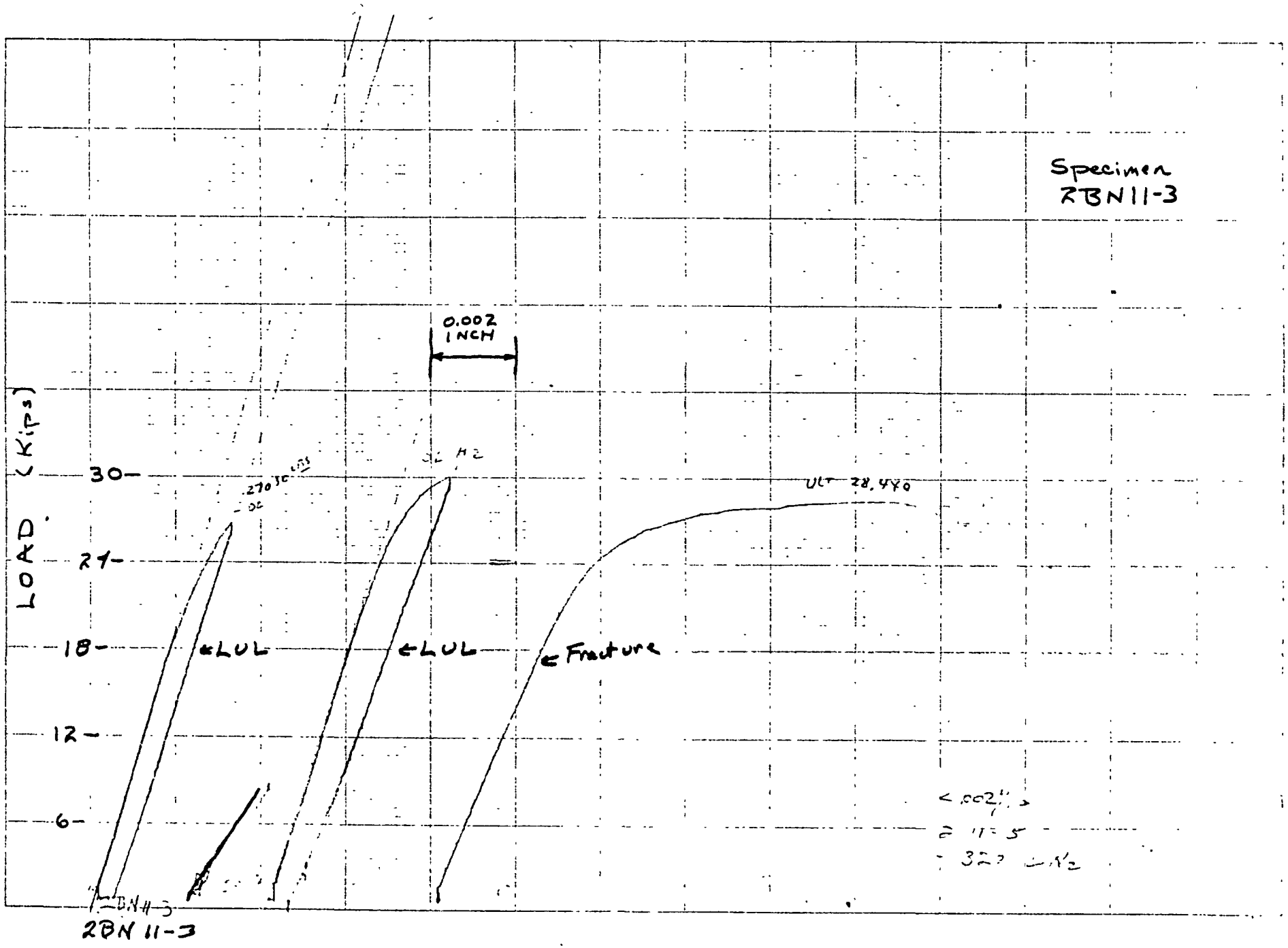

Specimen
3BR 34-2
280
240
200
160
120
80
40
LOAD (KIPS)
272,000
Fracture
0.002
INCH
3BR34-2

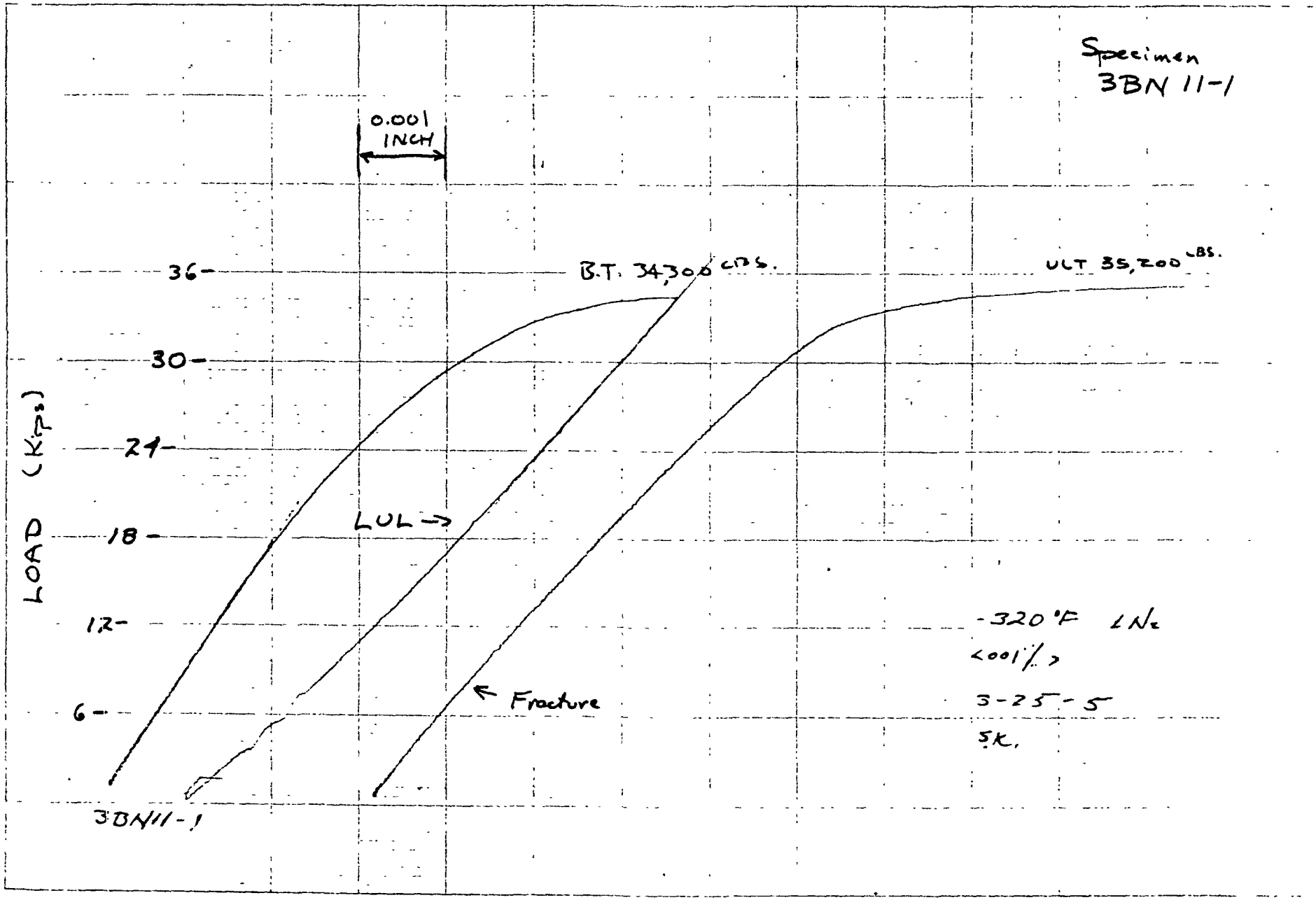

Specimen
ABR 34-1
0.002
INCH
280
240
200
160
120
80
40
LOAD (KIPS)
QL - 245,700
ULT 264,400
← LUL
Fracture
SF ~ 39 : 1


Specimen
4BR34-2
0.002
INCH
280
240
200
160
120
80
40
LOAD (Kips)
264,700
Fracture
←2UL

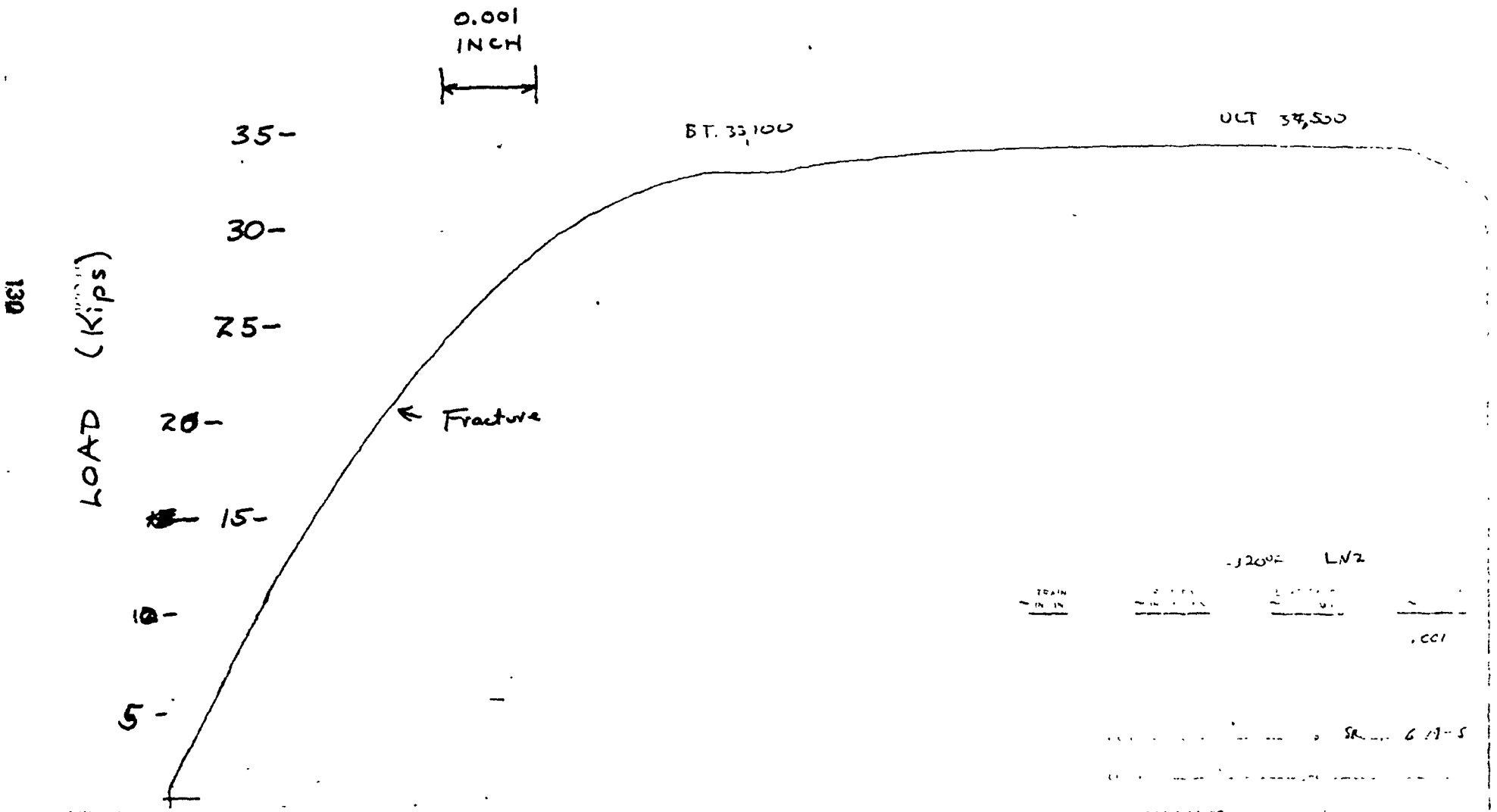

Specimen
2BN 11-1
0.002
INCH
36
30
21
10
12
6
LOAD (KIPS)
0.L. 33,870 LBS.
R.T.
ULT 28,500 #
ELUL
Fracture
2BN11-1
<.002"
- 320°F LN2
2 x 10 - 5 SR


Specimen
2BN11-2
0.002
INCH
LOAD (Kips)
36
30
21
18
12
6
30,050 Lbs
29,280 Lbs
@ 25,800 Lbs
LUL
Fracture
2BN11-2

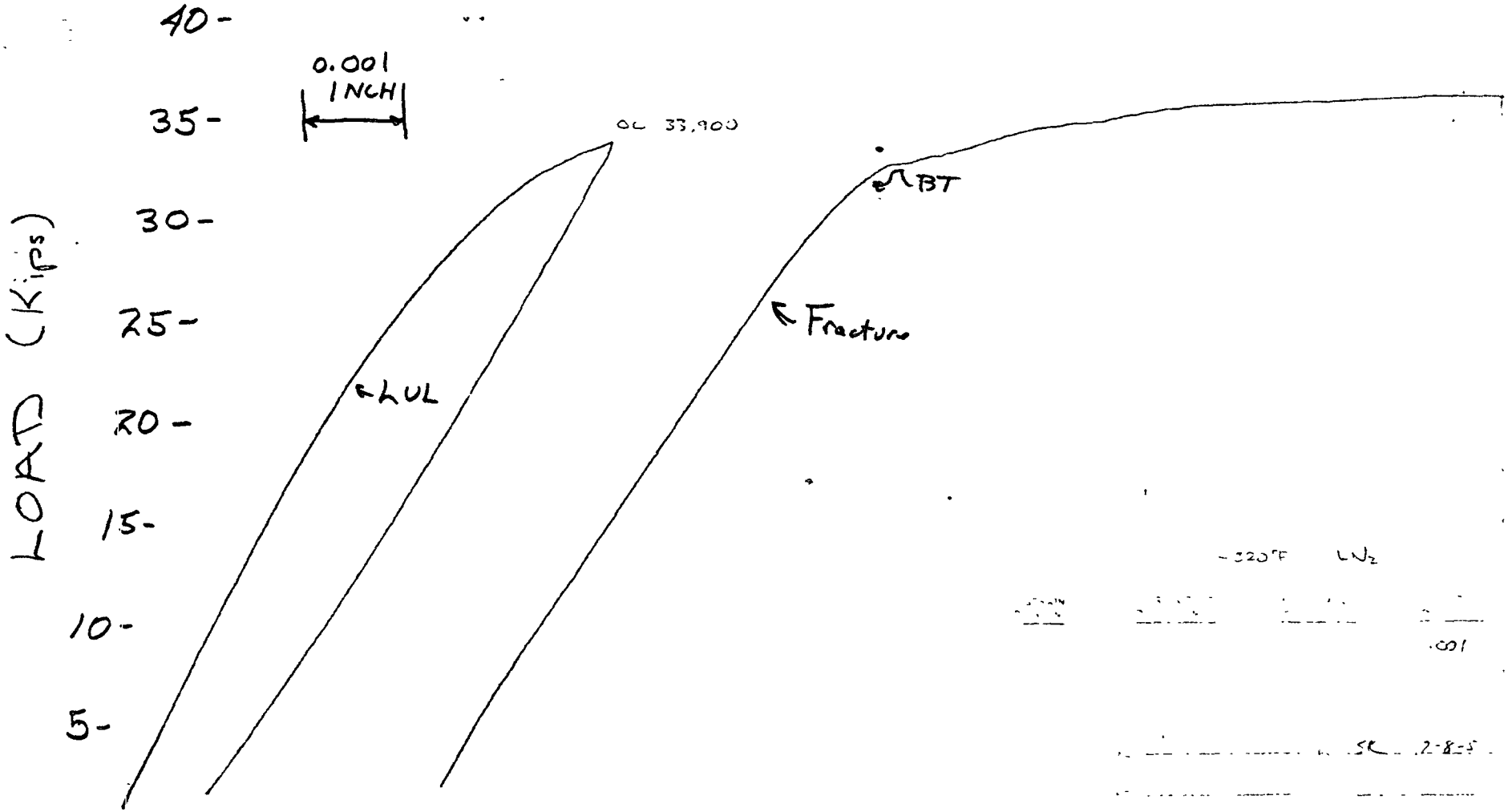

Specimen
2BN11-3
0.002
INCH
LOAD (Kips)
30
24
18
12
6
←LUL
←LUL
←Fracture
ULT 28.4X0
<.002"
2BN11-3


Specimen
3BN 11-1
0.001
INCH
36
30
24
18
12
6
LOAD (Kips)
B.T. 34,300 LBS.
ULT 35,200 LBS.
LUL →
← Fracture
-320 °F LN2
<001>
3-25-5
5K,
3BN11-1

Specimen
3BN 11-2



Specimen
4BN11-1

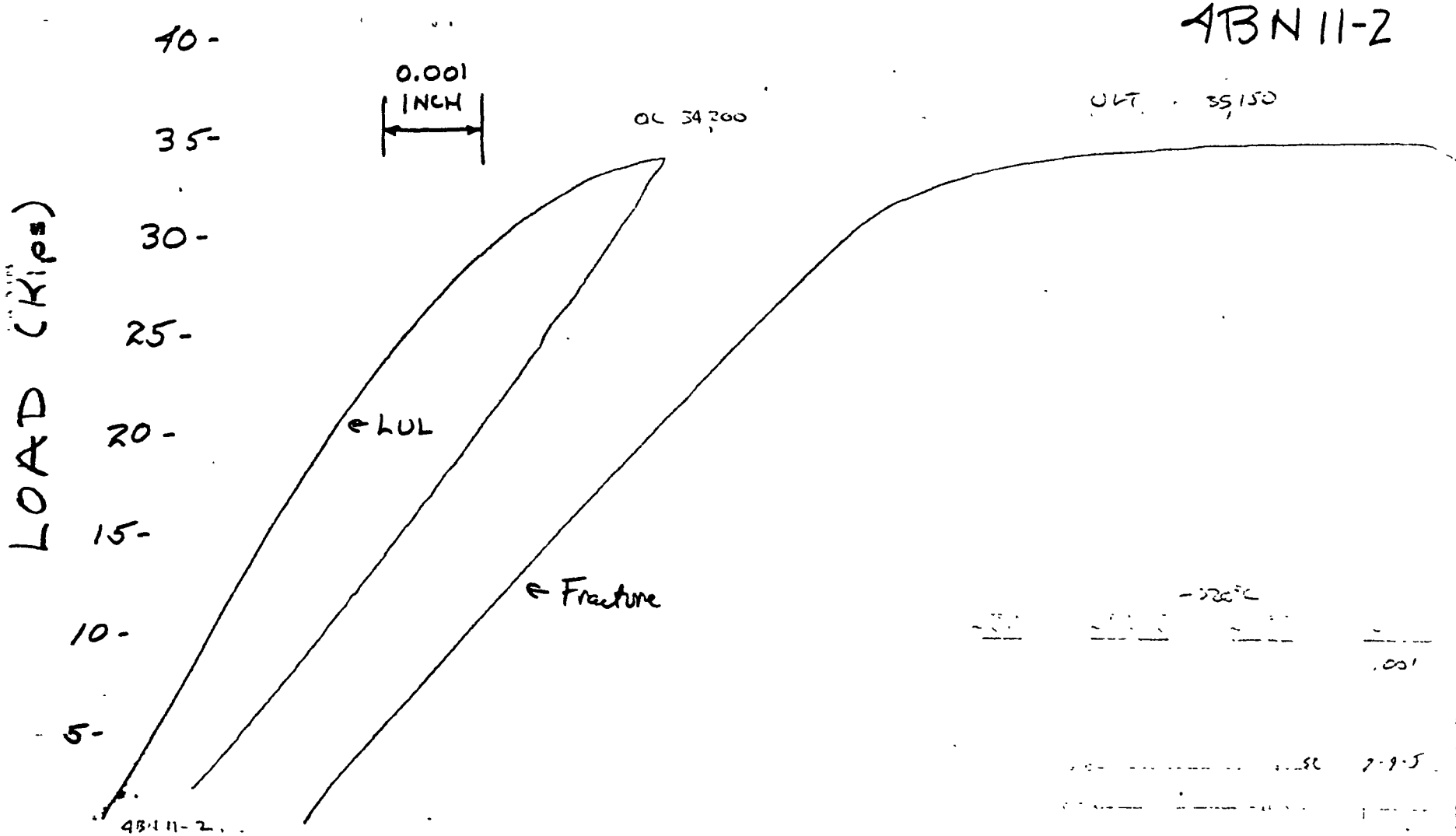


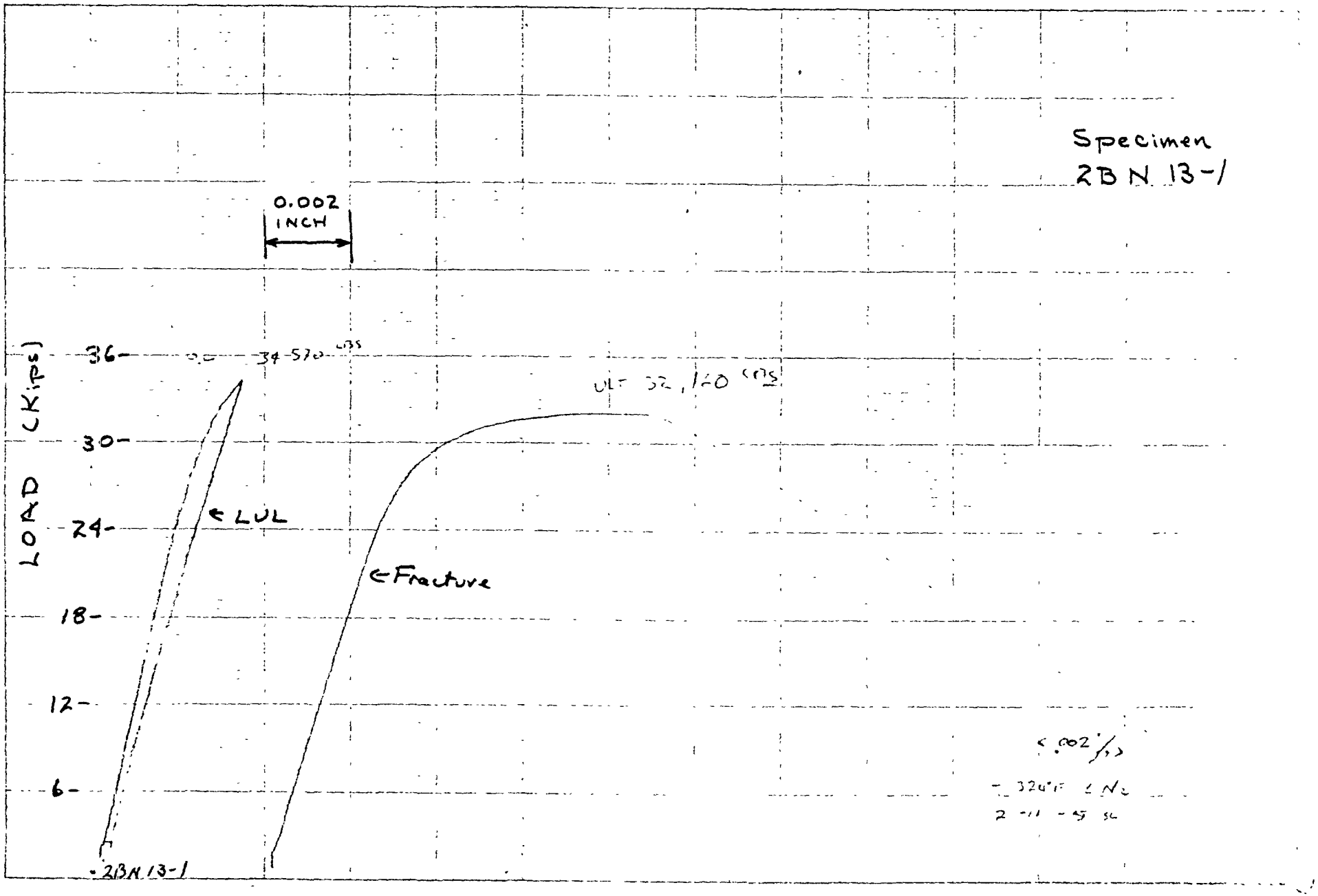
-320°F LN2

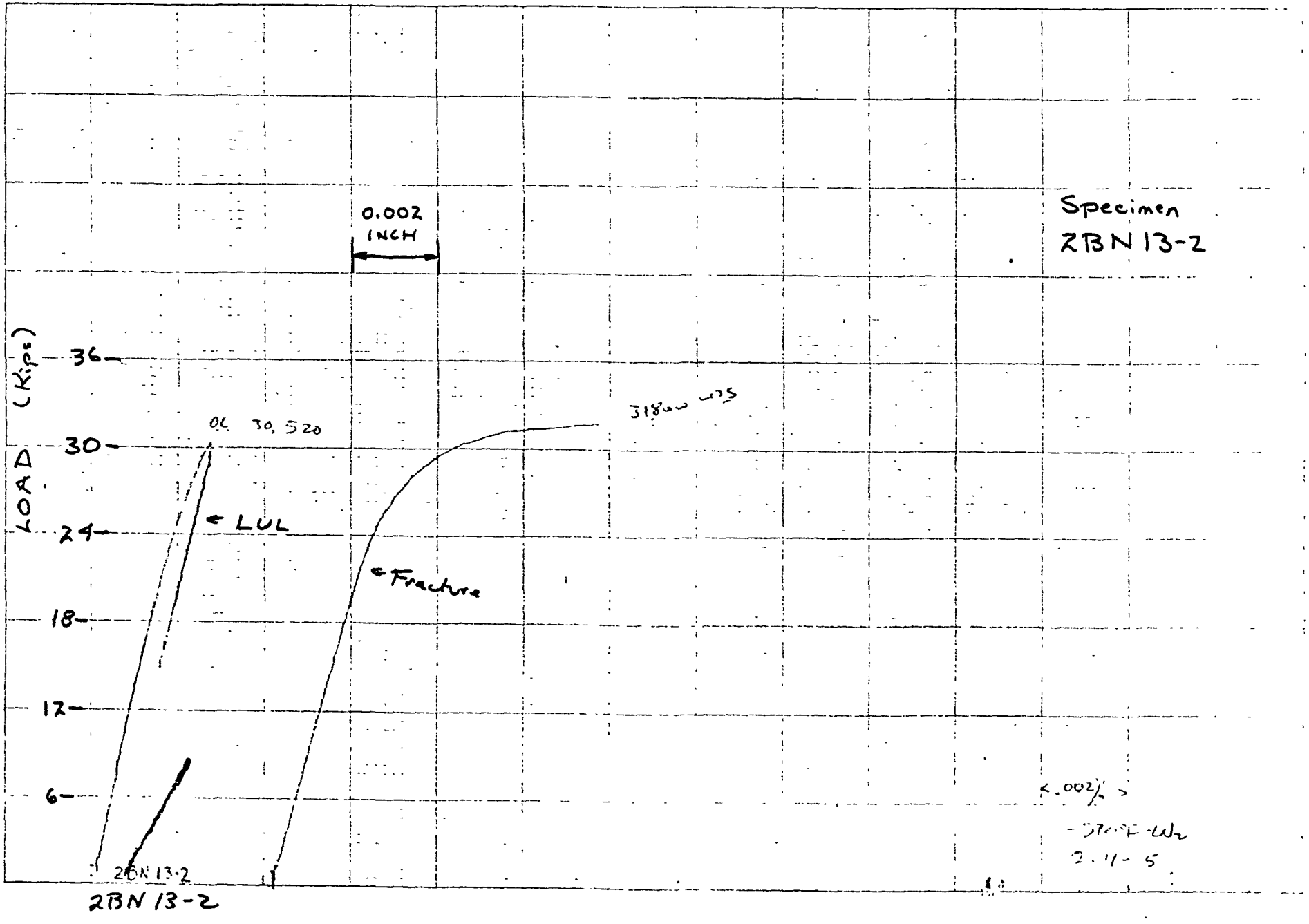
.001

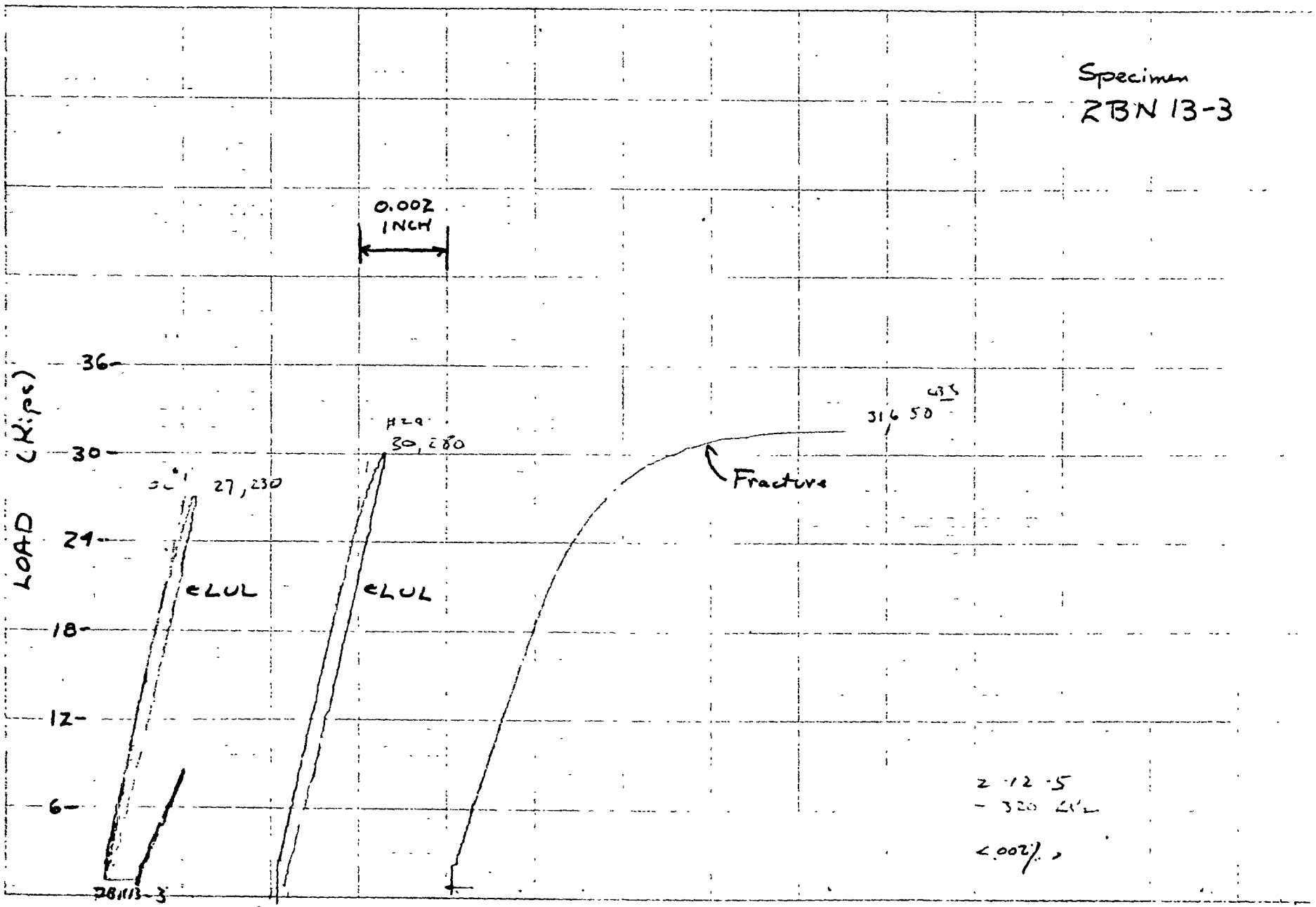
SR 2-8-5

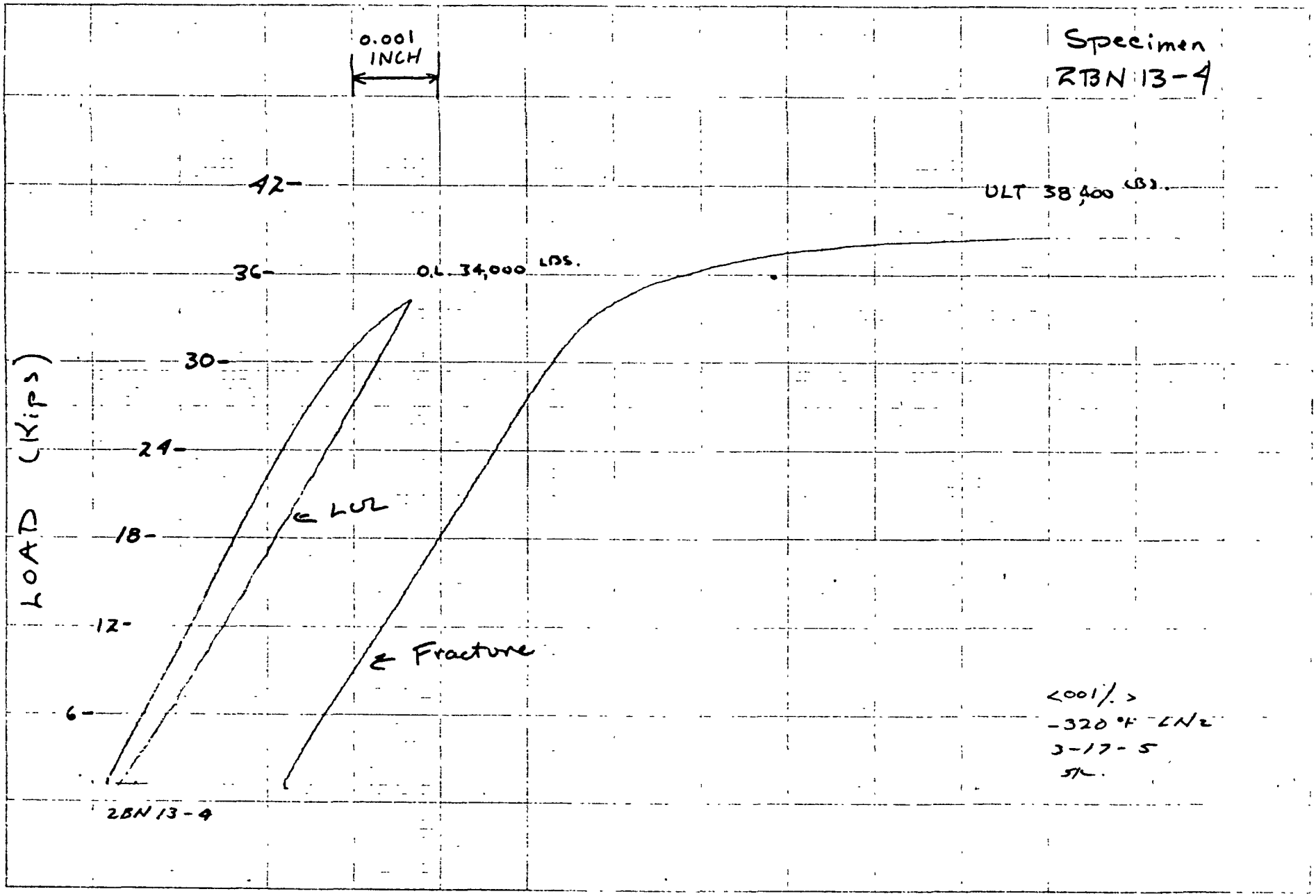
Specimen
4BN11-2



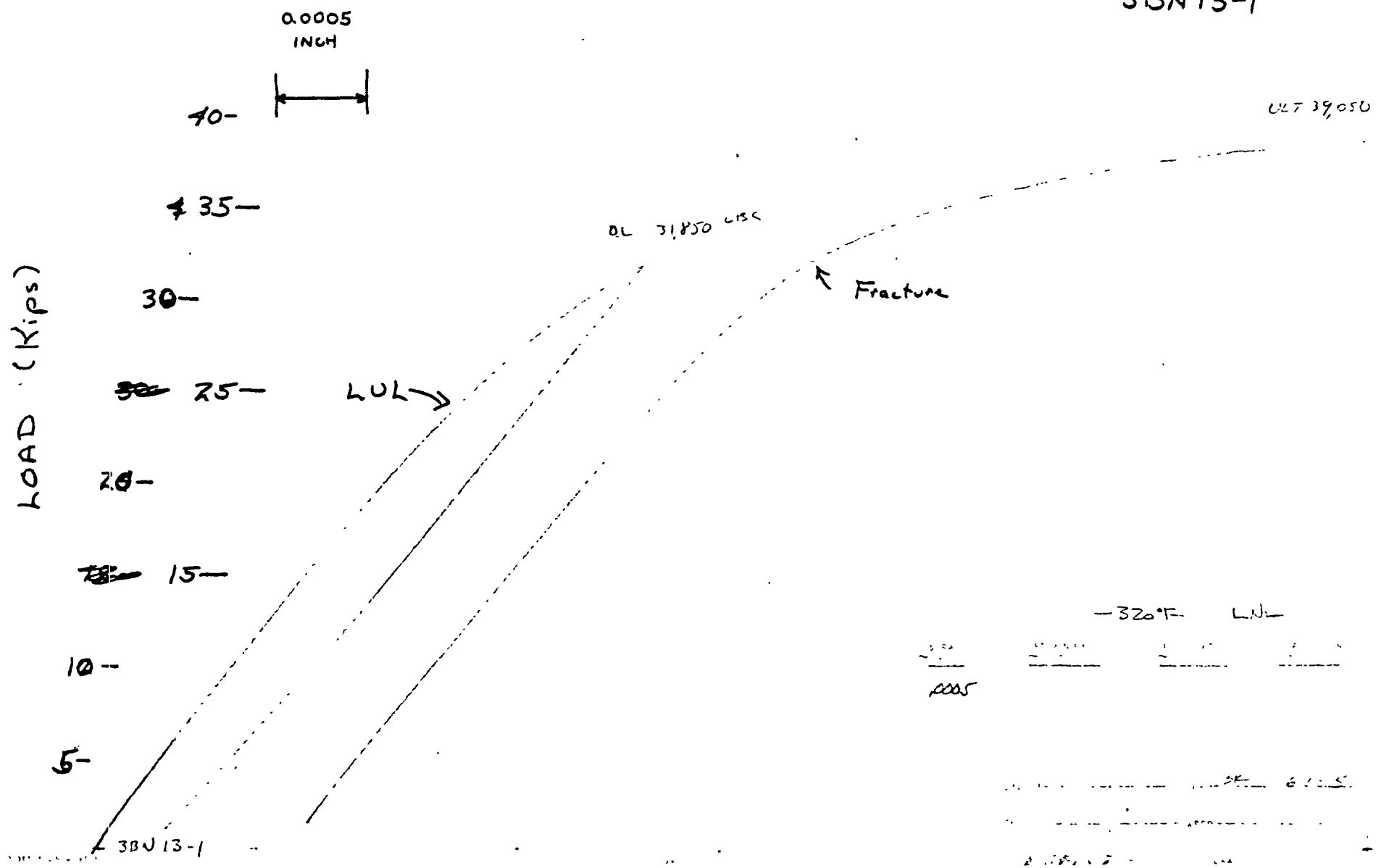

Specimen
2B N 13-1
0.002
INCH
LOAD (Kips)
36
30
24
18
12
6
34,570 PSI
ULT 32,140 PSI
← LUL
← Fracture
2B N 13-1
< .002 /in
- 320°F ℓ N₂
2 min - 5 sec


0.002 INCH
Specimen 2BN13-2
LOAD (Kips)
36
30
24
18
12
6
OL 30,520
318[illegible]
← LUL
← Fracture
2BN13-2
2BN13-2

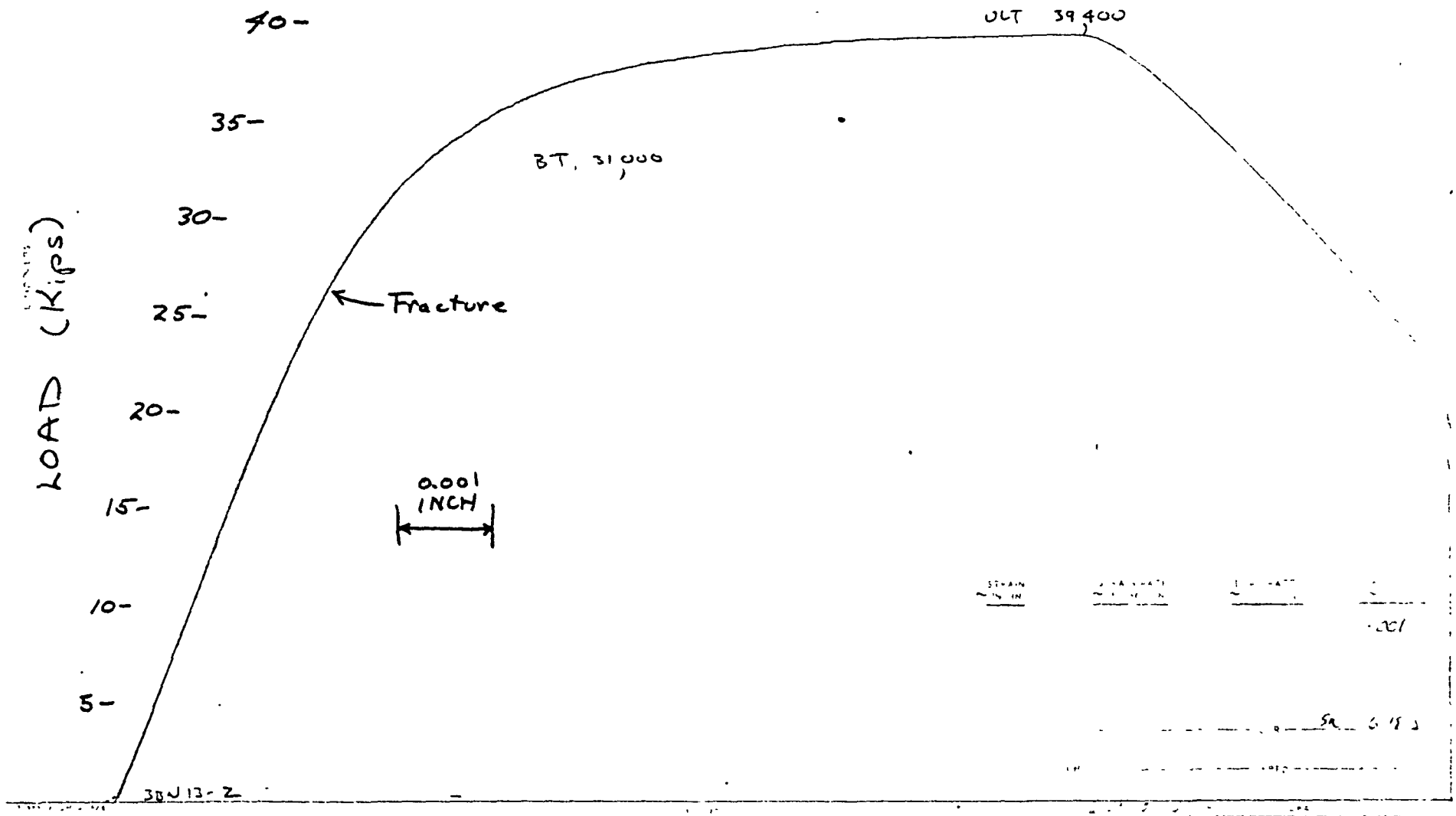

Specimen
ZBN 13-3
0.002
INCH
LOAD (Kips)
36
30
24
18
12
6
27,230
ELUL
30,280
ELUL
31,650
Fracture
Z-12-5
- 320 ELL
<.002"
ZBN13-3

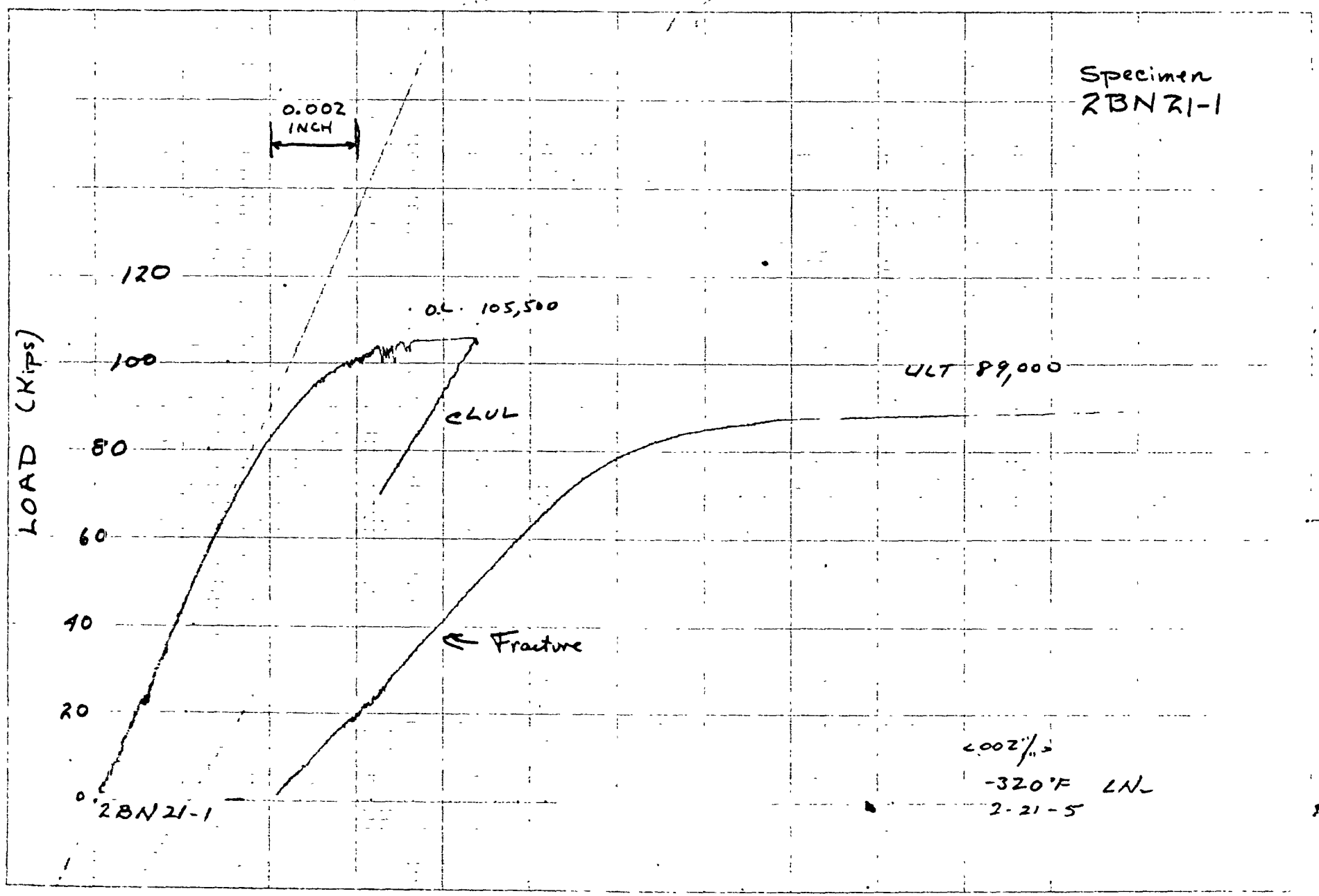

0.001 INCH
Specimen
2BN 13-4
42
36
30
24
18
12
6
LOAD (Kips)
ULT 38,400 LBS.
O.L. 34,000 LBS.
← U.L.
← Fracture
<001/>
-320°F LN2
3-17-5
SK.
2BN 13-4

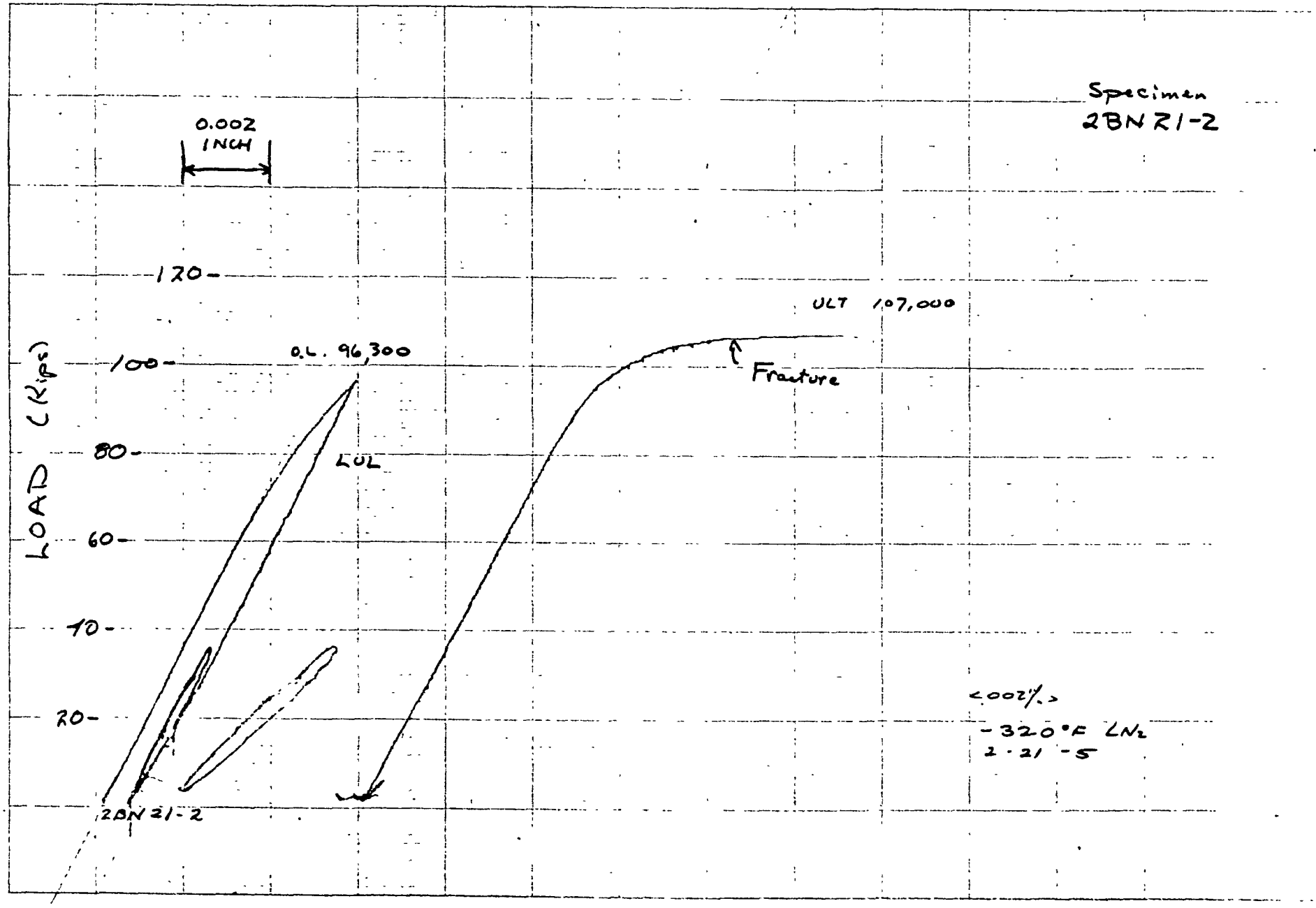
Specimen
3BN13-1

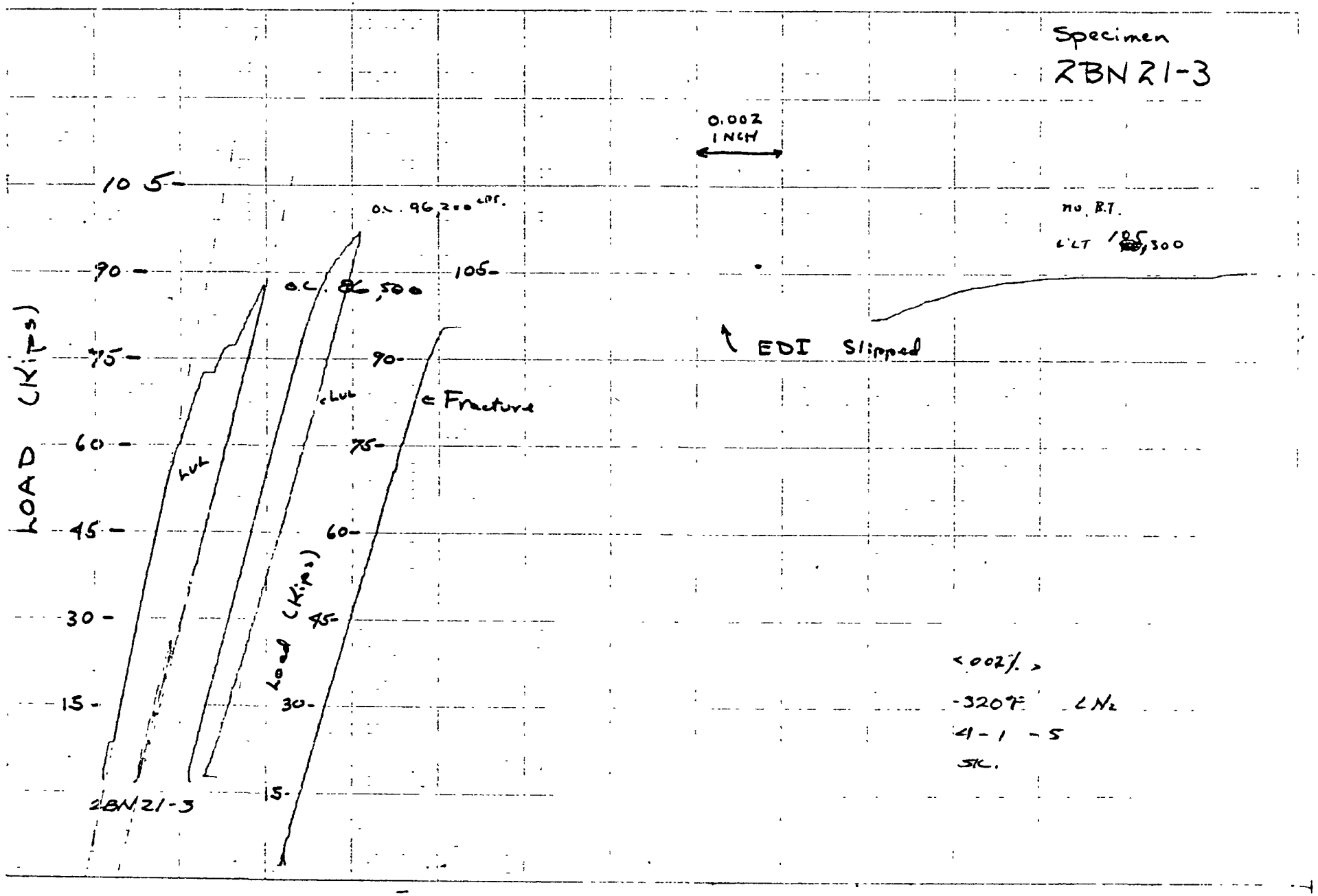


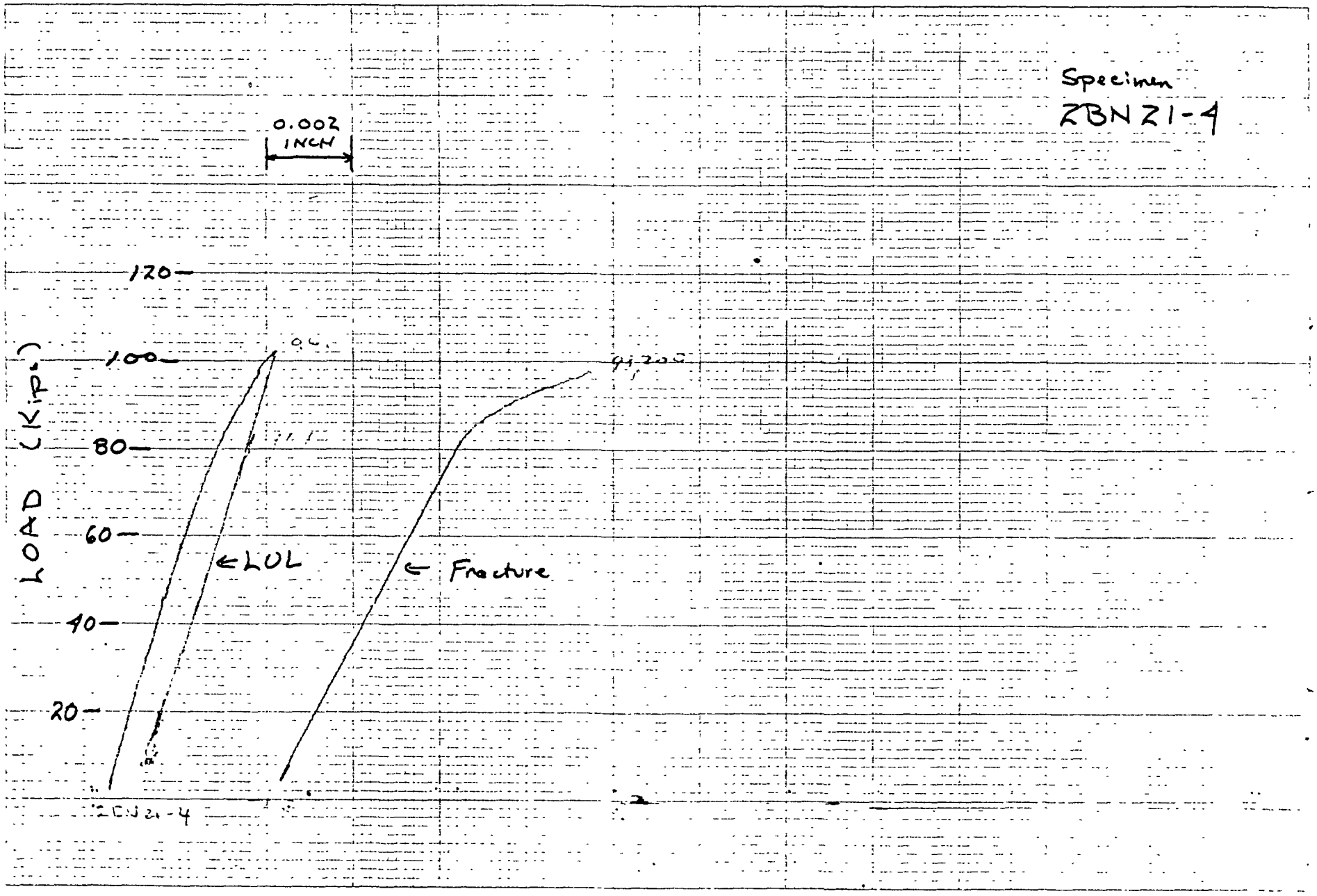
Specimen
3BN 13-2

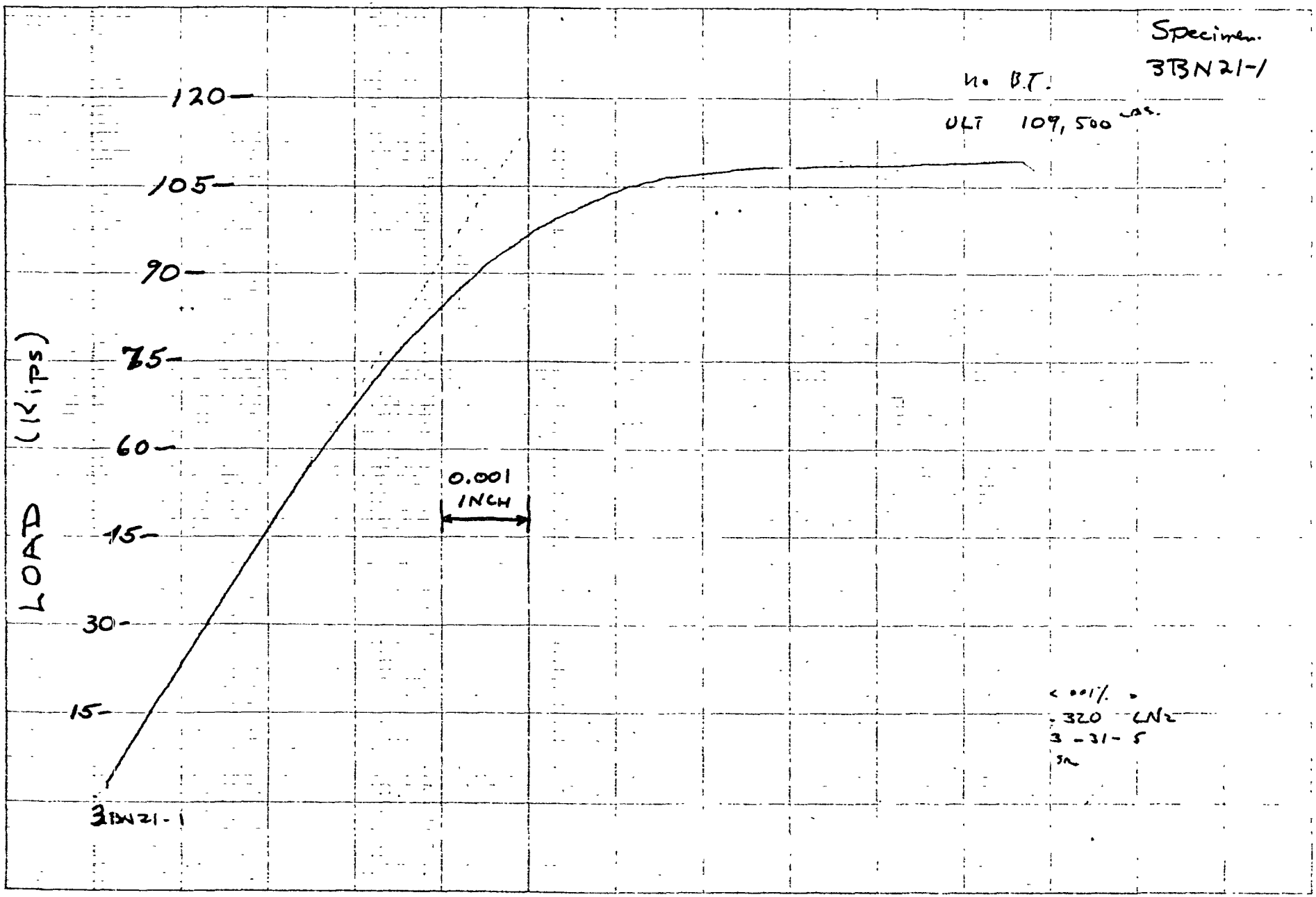


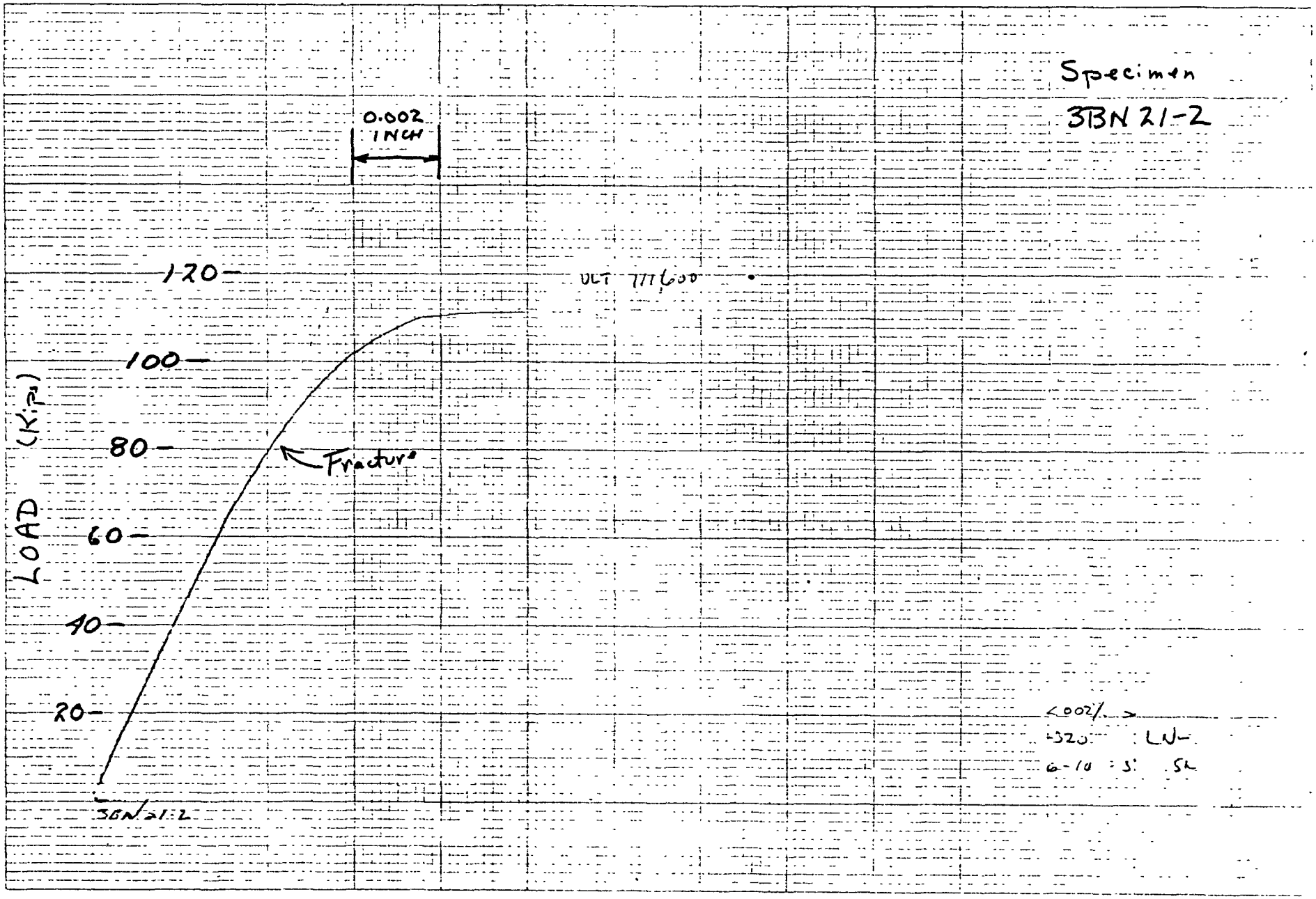

Specimen
2BN21-1
0.002
INCH
LOAD (KIPS)
120
100
80
60
40
20
0
O.L. 105,500
ULT 89,000
ELUL
Fracture
2BN21-1
<.002"/"
-320°F LN
2-21-5

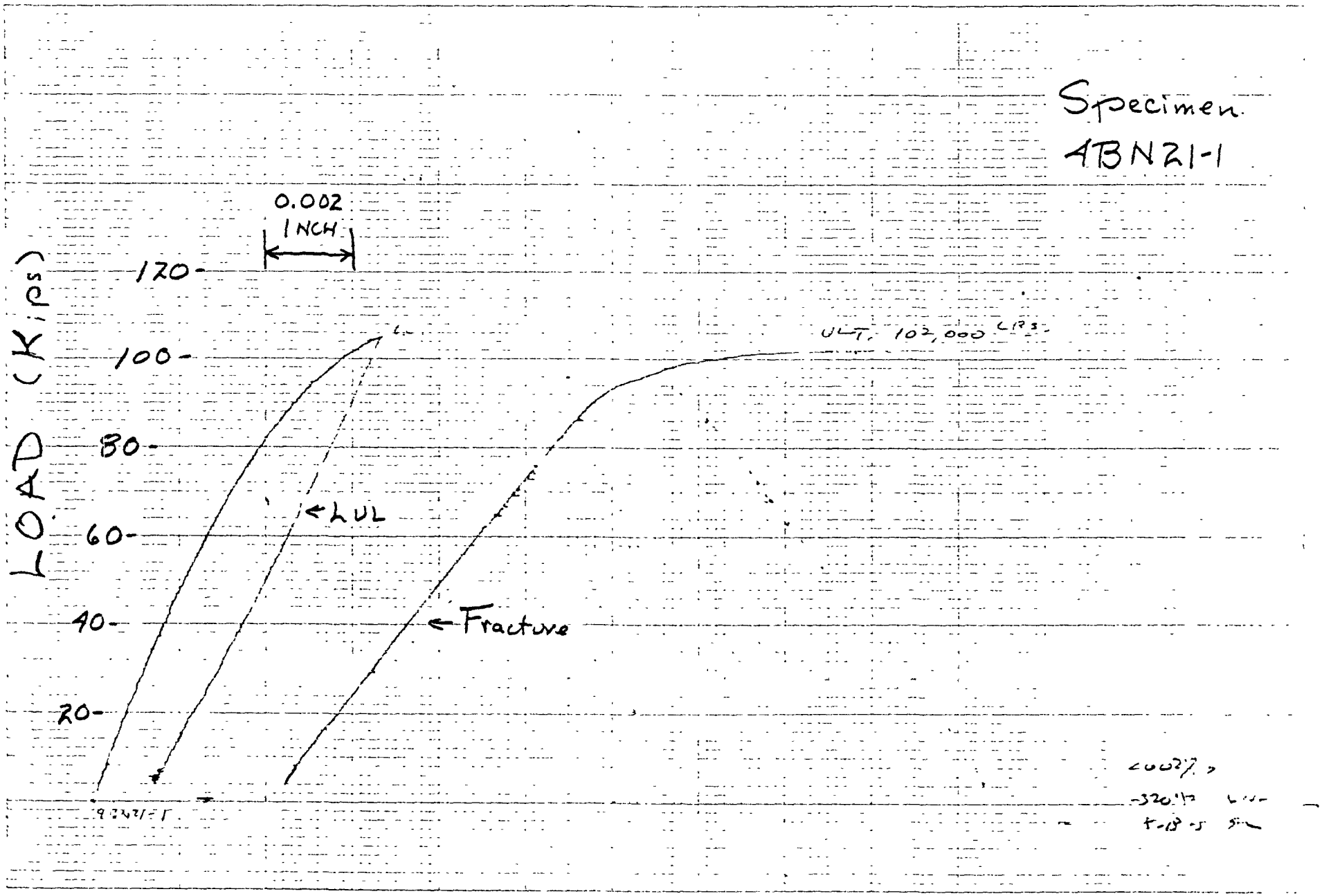

Specimen
2BN21-2
0.002
INCH
120
100
80
60
40
20
LOAD (Kips)
O.L. 96,300
LOL
ULT 107,000
Fracture
<.002"/>
-320°F LN2
2-21-5
2BN21-2

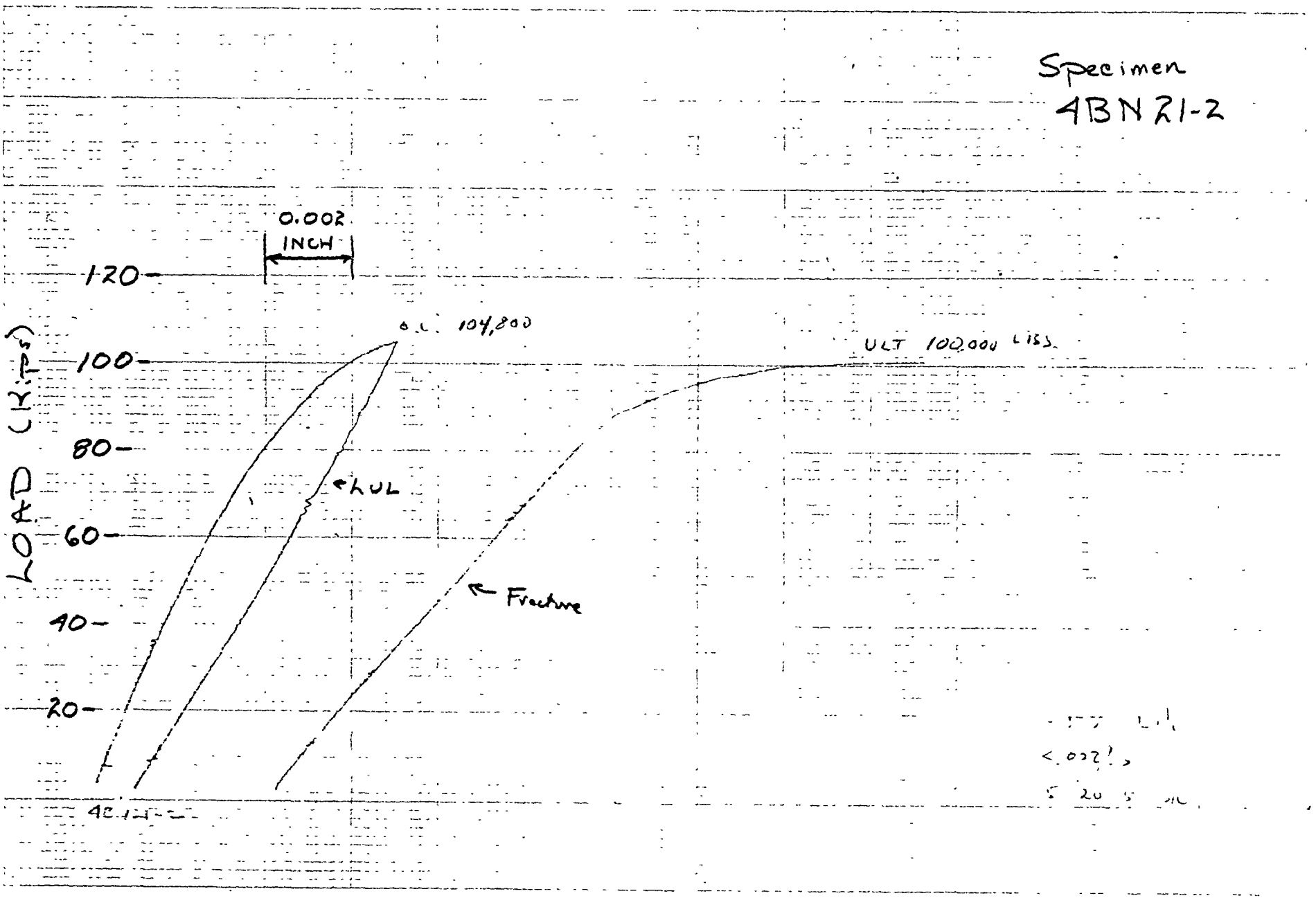

Specimen
ZBN21-3
0.002 INCH
LOAD (Kips)
105
90
75
60
45
30
15
O.C. 96,200 cps.
O.C. 82,500
Fracture
EDI Slipped
no B.T.
LLT 105,300
<.002"
-320°F LN2
41-1-5
SK.
ZBN21-3

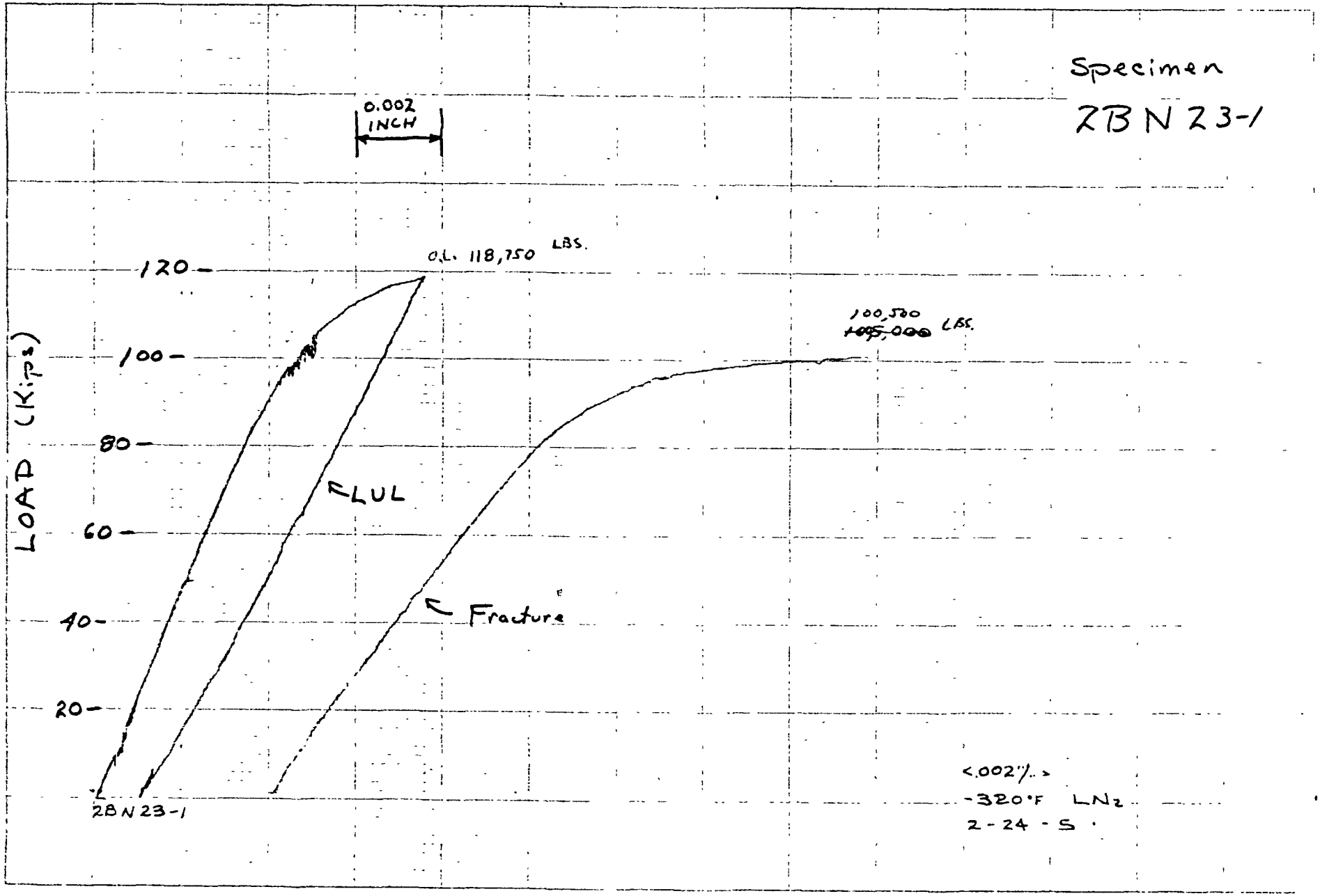

Specimen
ZBNZ1-4
0.002
INCH
120
100
80
60
40
20
LOAD (Kips)
←LOL
← Fracture
ZBNZ1-4

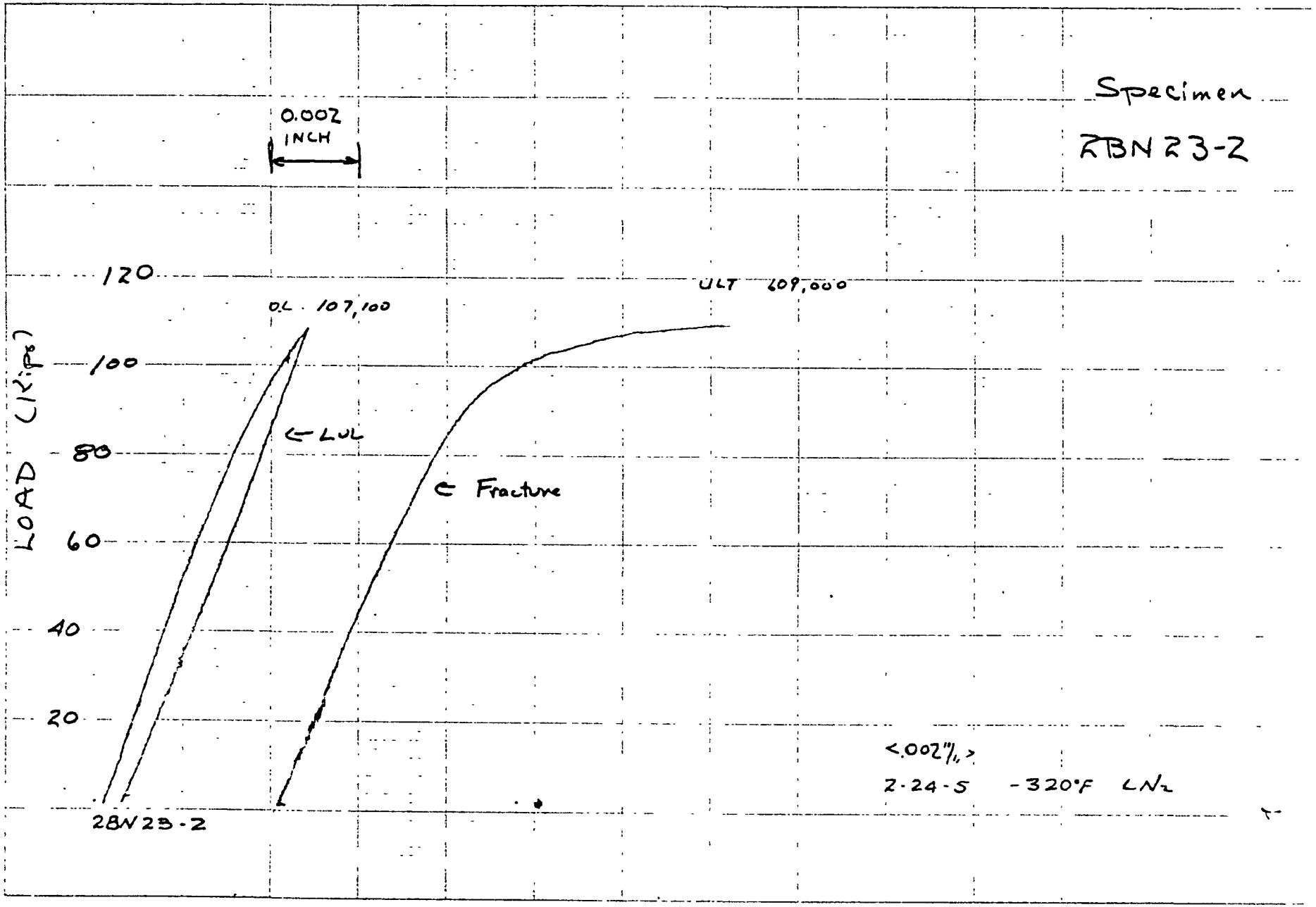

Specimen
3BN21-1
No. B.T.
ULT 109,500 psi.
120
105
90
75
60
45
30
15
LOAD (Kips)
0.001
INCH
3BN21-1
< .01%
-320 LN2
3-31-5

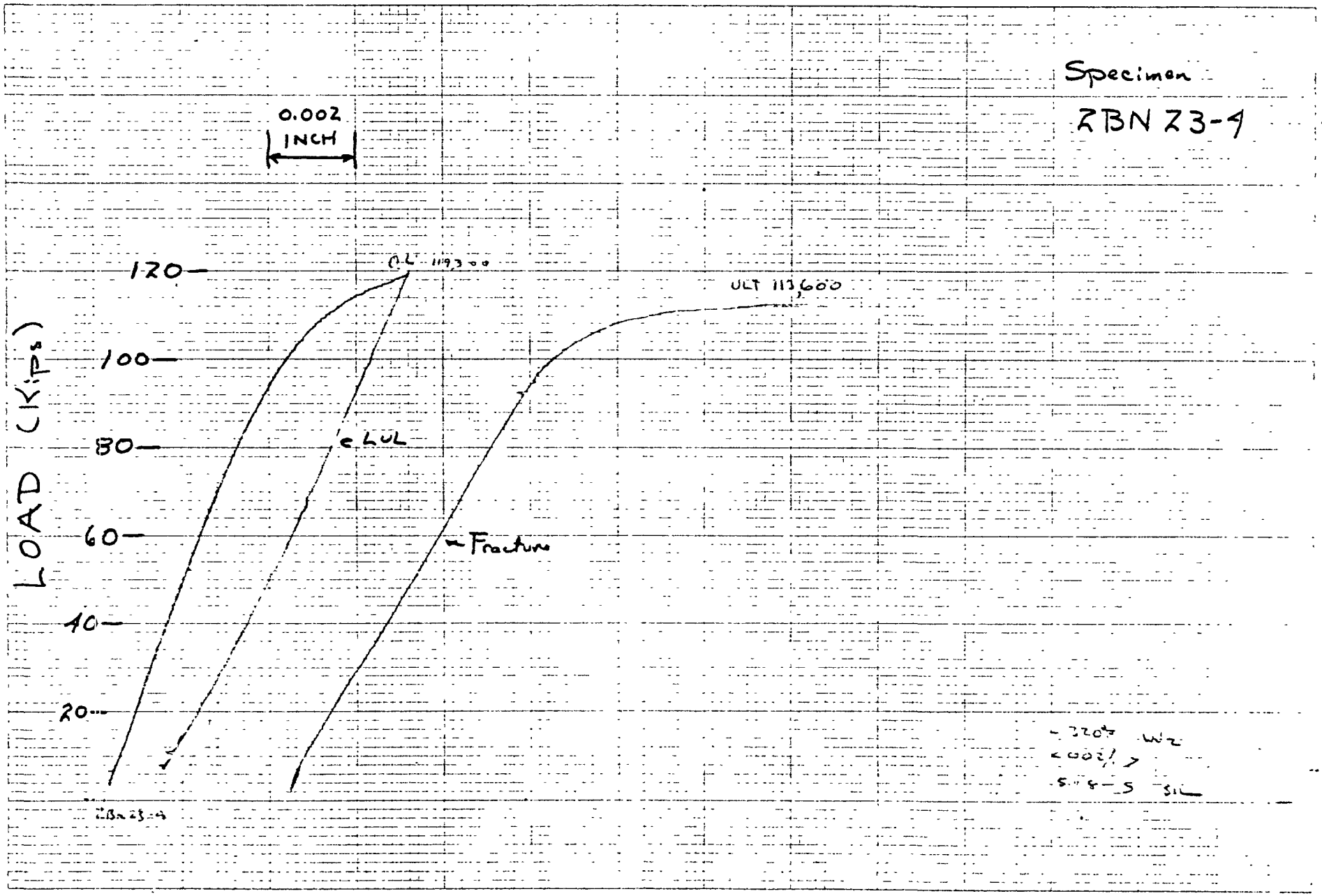

Specimen
3BN 21-2
0.002
INCH
120
100
80
60
40
20
LOAD (KIPS)
ULT 77,600
Fracture
3BN 21-2
<.002/
-320 : LN-
6-10 : SL

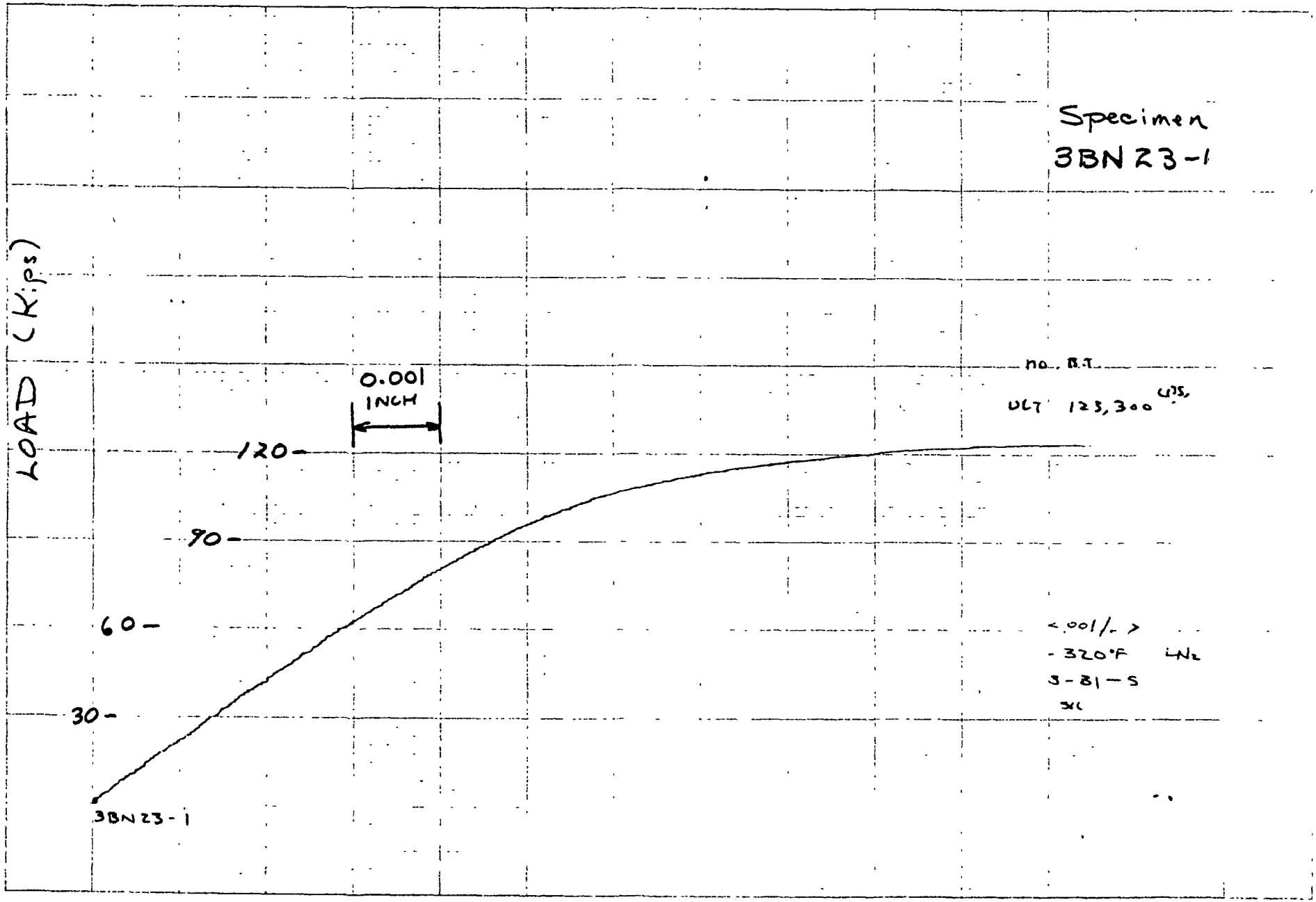

Specimen
AB N21-1
0.002
INCH
LOAD (Kips)
120
100
80
60
40
20
ULT. 102,000 LBS.
← 2 UL
← Fracture

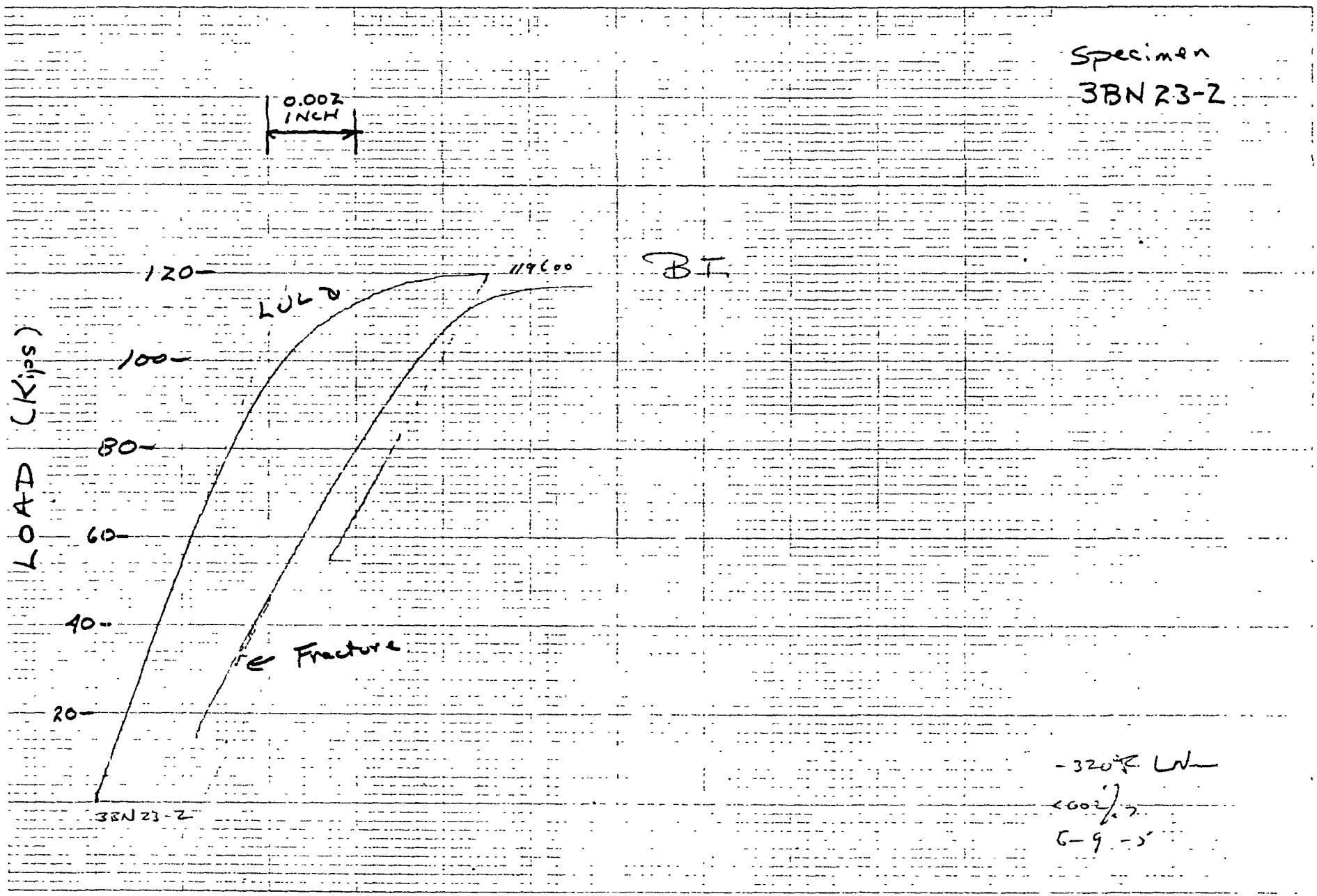

Specimen
4BN21-2
0.002
INCH
120
100
80
60
40
20
LOAD (KIPS)
P.L. 104,800
ULT 100,000 LBS.
PUL
Fracture

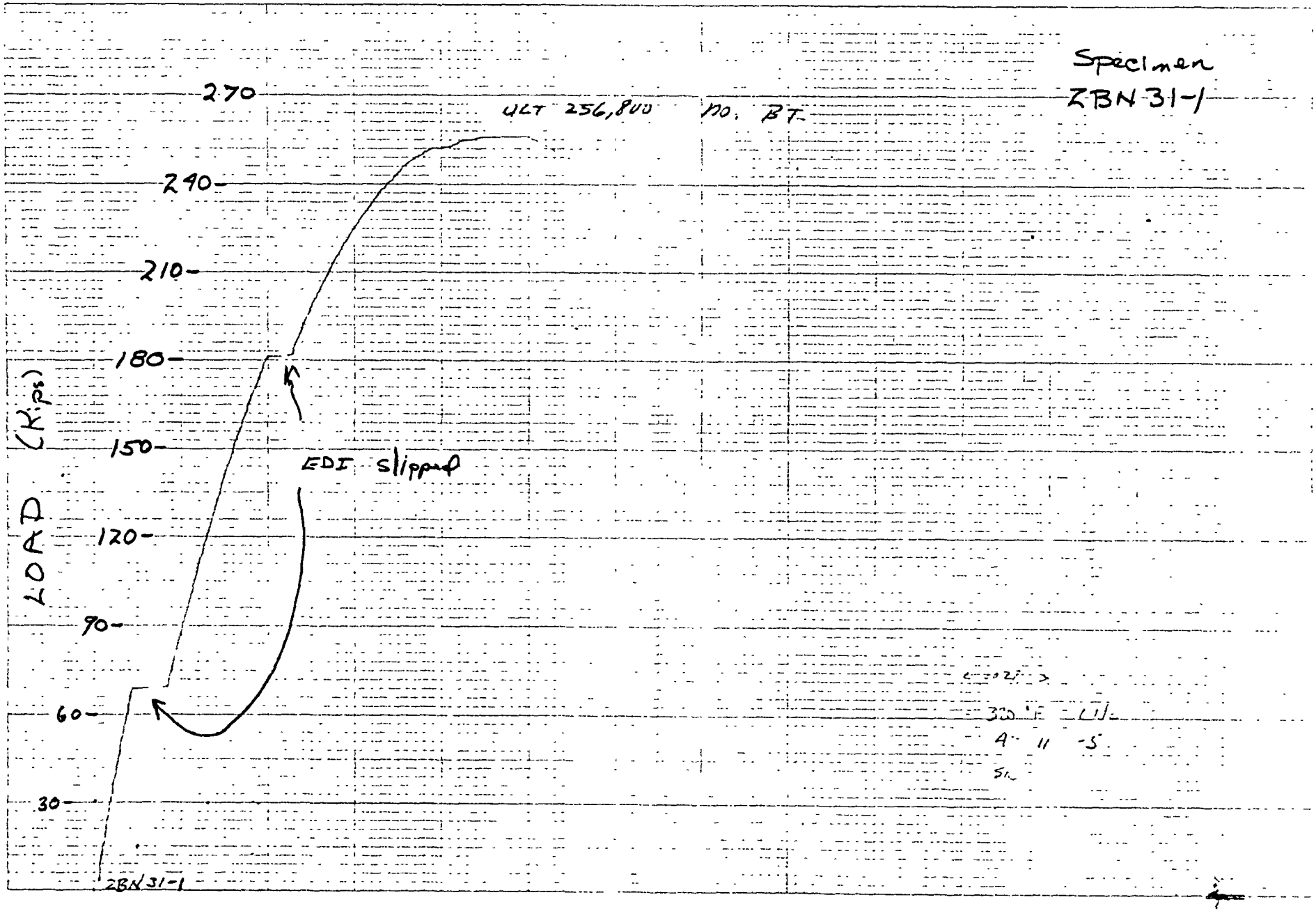

Specimen
2BN23-1
0.002 INCH
O.L. 118,750 LBS.
100,500 LBS.
LOAD (Kips)
120
100
80
60
40
20
LUL
Fracture
2BN23-1
<.002"/..>
-320°F LN2
2-24-5

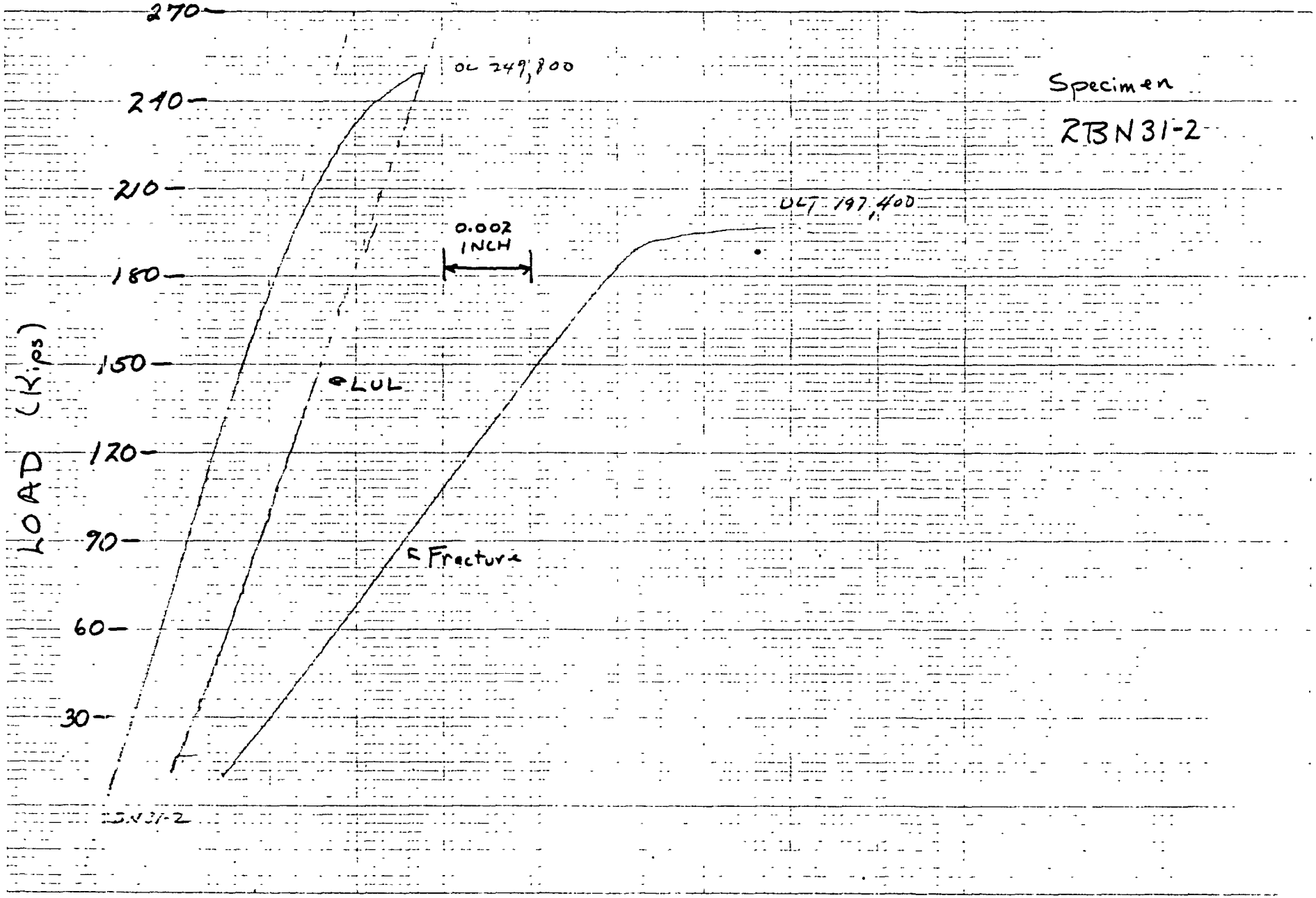

Specimen
2BN23-2
0.002
INCH
120
100
80
60
40
20
LOAD (Kips)
0.L. 107,100
ULT 109,000
← LUL
← Fracture
<.002"/,>
2-24-5 -320°F LN2
28N23-2

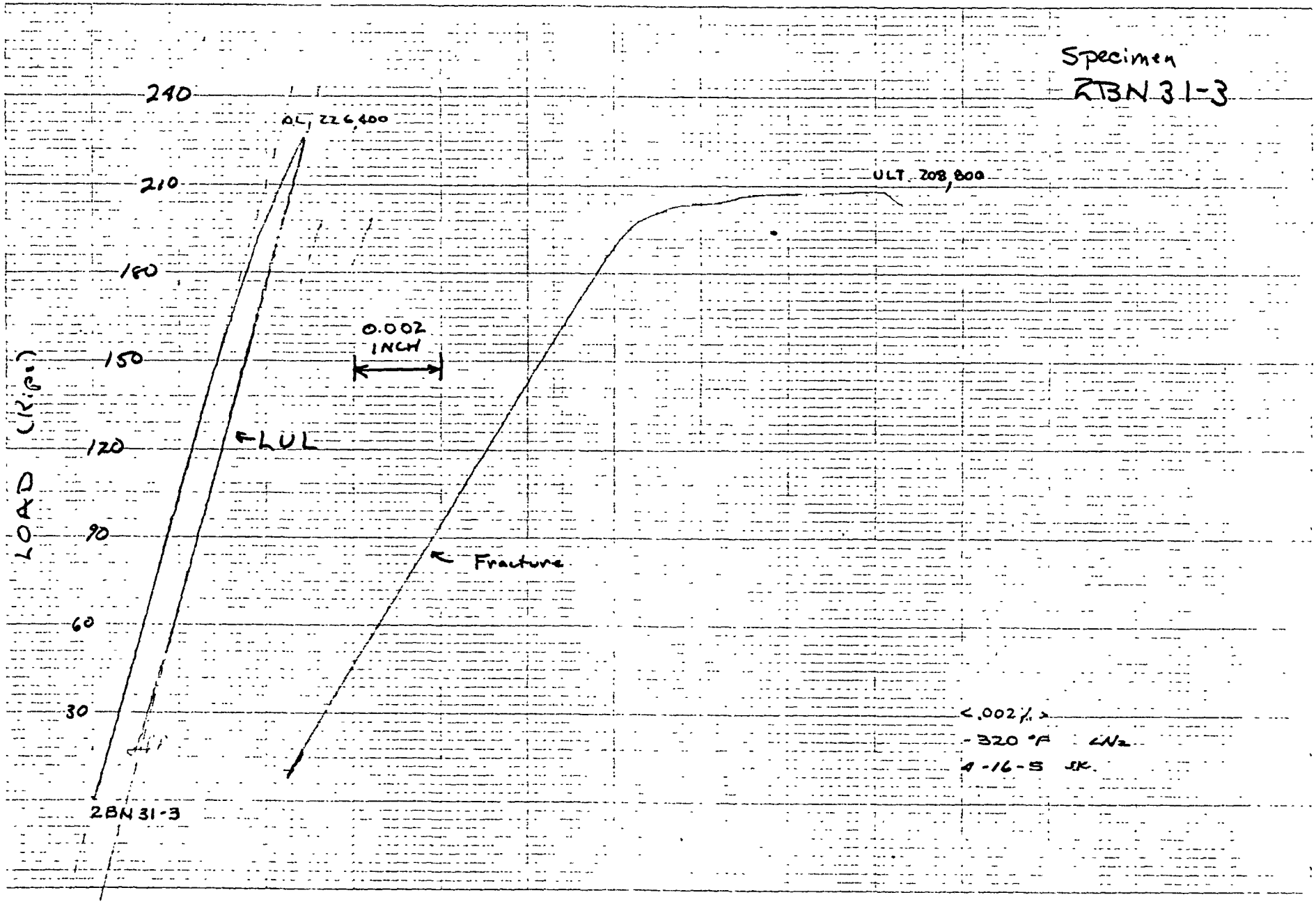

Specimen
ZBNZ3-4
0.002
INCH
LOAD (KIPS)
120
100
80
60
40
20
ULT 113,600
Fracture
ZBNZ3-4

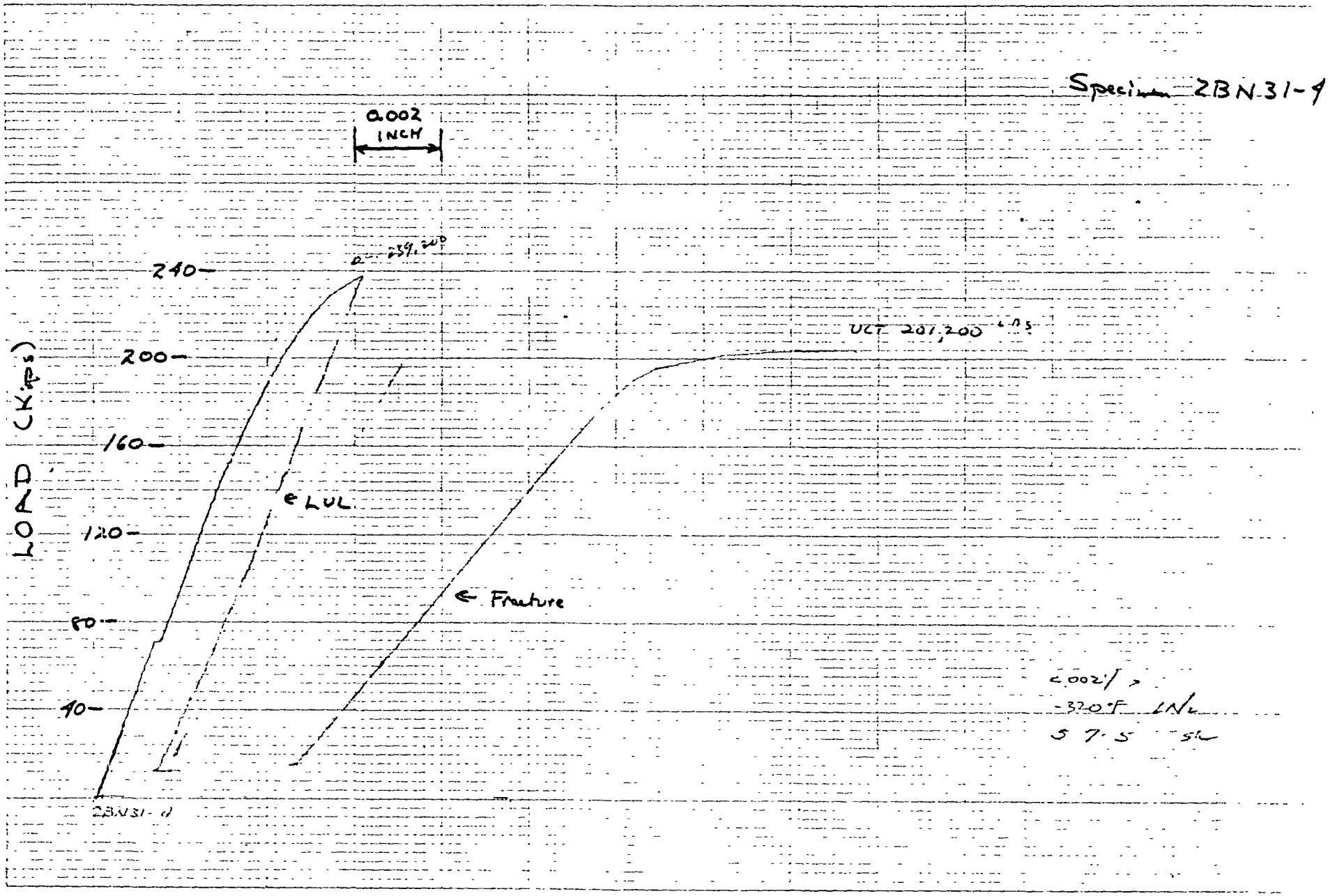

Specimen
3BN23-1
LOAD (K.ips)
0.001
INCH
120
90
60
30
3BN23-1
no. B.T.
ULT 123,300 LBS.
<.001/_>
-320°F LN2
3-81-S
XC

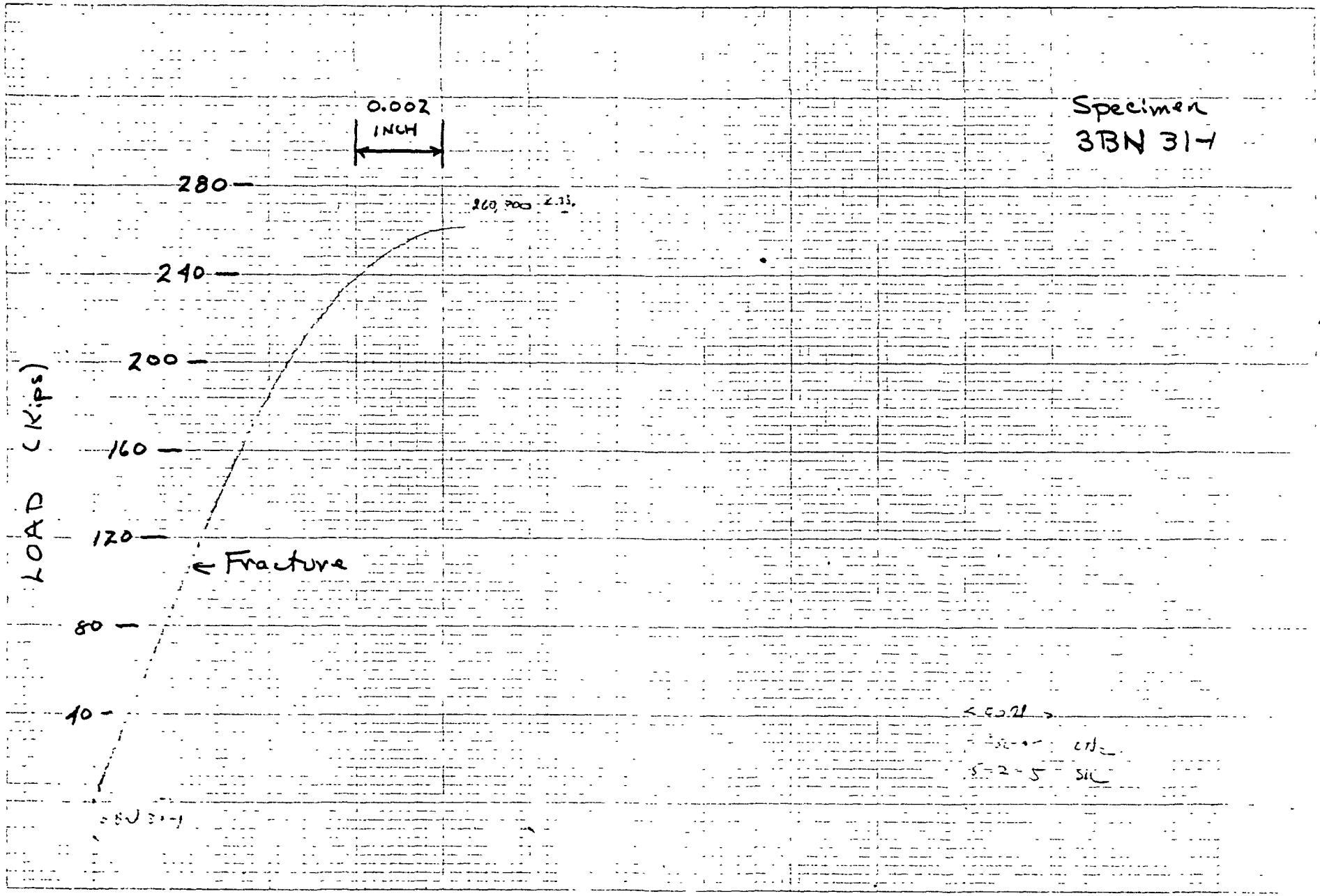

Specimen
3BN23-Z
0.002 INCH
120
100
80
60
40
20
LOAD (Kips)
LUL
BT
Fracture
3BN23-Z
-320°F LN
<.002
6-9-5

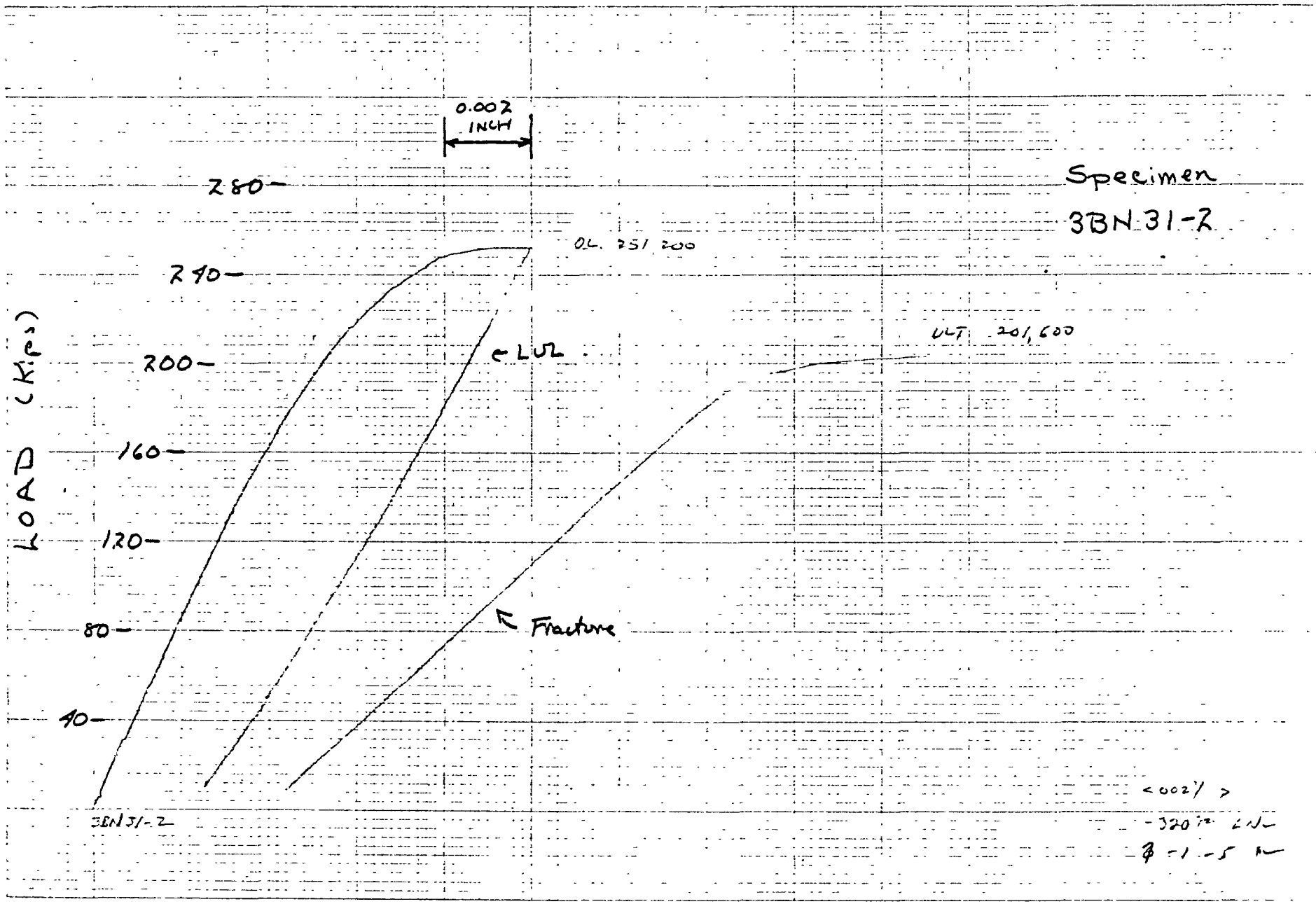

Specimen
ZBN-31-1
ULT 256,800 lbs. BT
270
240
210
180
150
120
90
60
30
LOAD (Kips)
EDI slipped
ZBN31-1

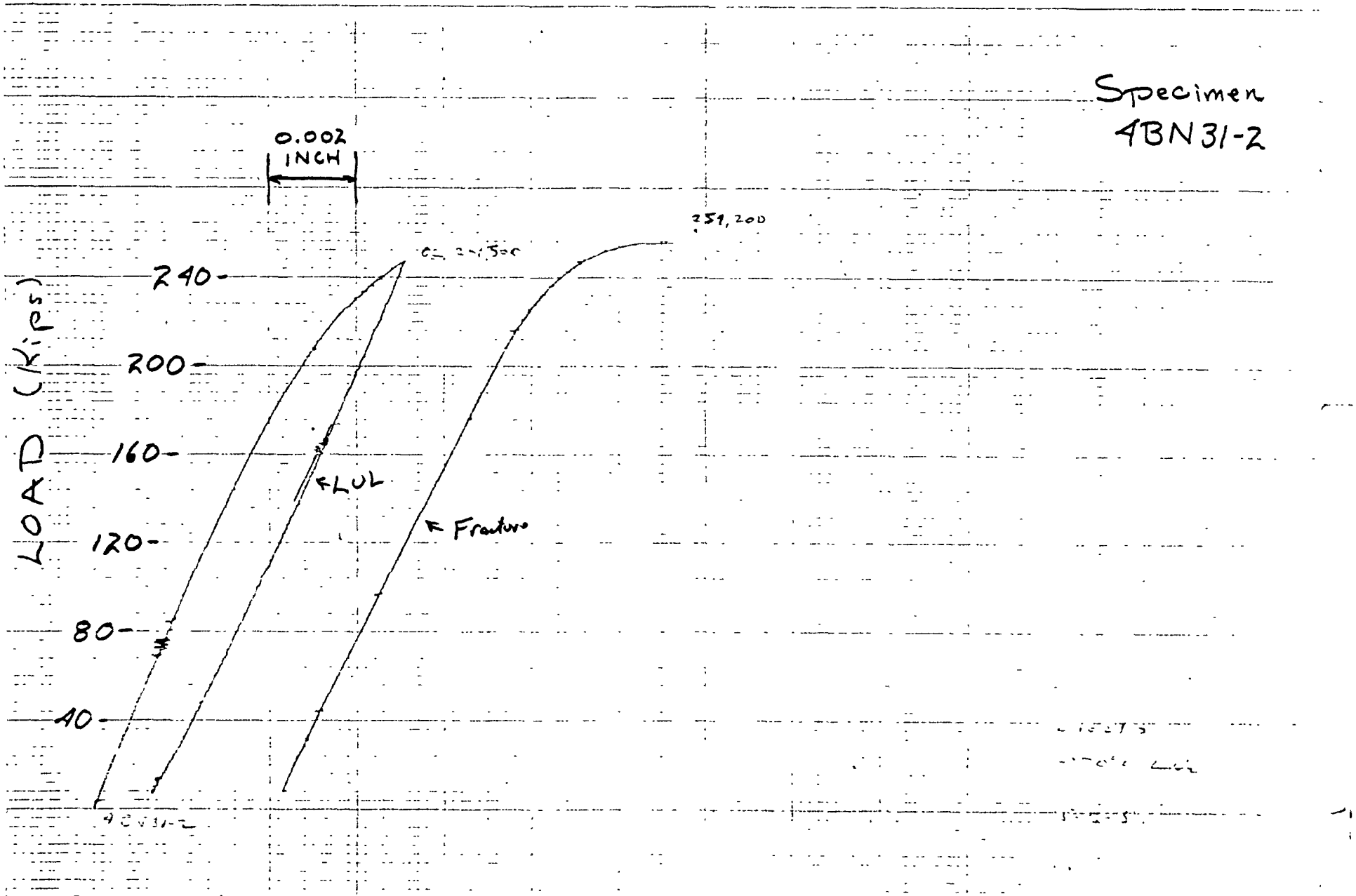

Specimen
2TBN31-2
OL 249,800
ULT 197,400
0.002
INCH
LOL
Fracture
LOAD (Kips)
270
240
210
180
150
120
90
60
30
2TBN31-2

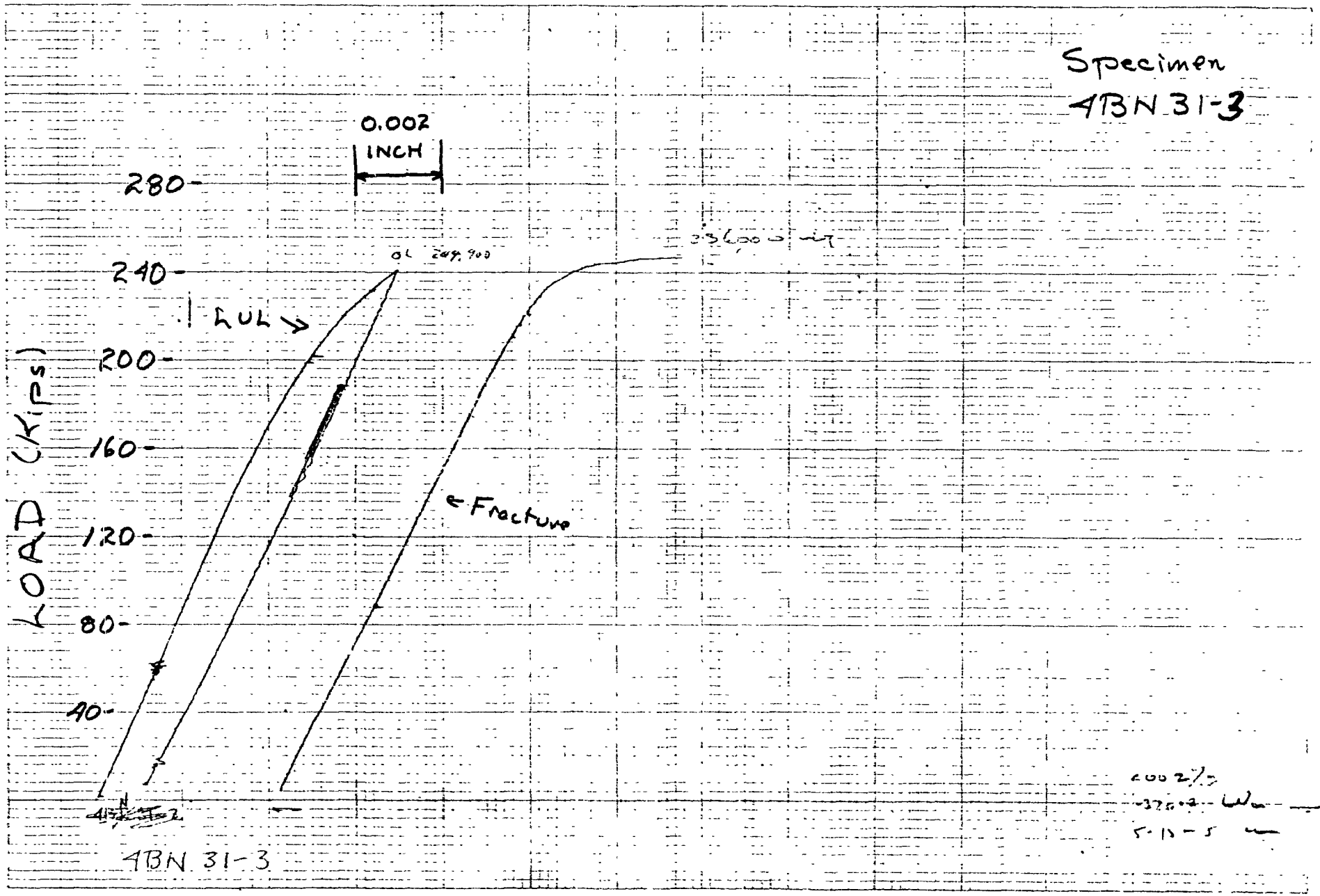

Specimen
2BN 31-3
240
210
180
150
120
90
60
30
LOAD (KIPS)
PUL 226,400
ULT 208,800
0.002 INCH
PUL
Fracture
2BN 31-3
<.002 in.
-320 °F LN2
4-16-5 JK.

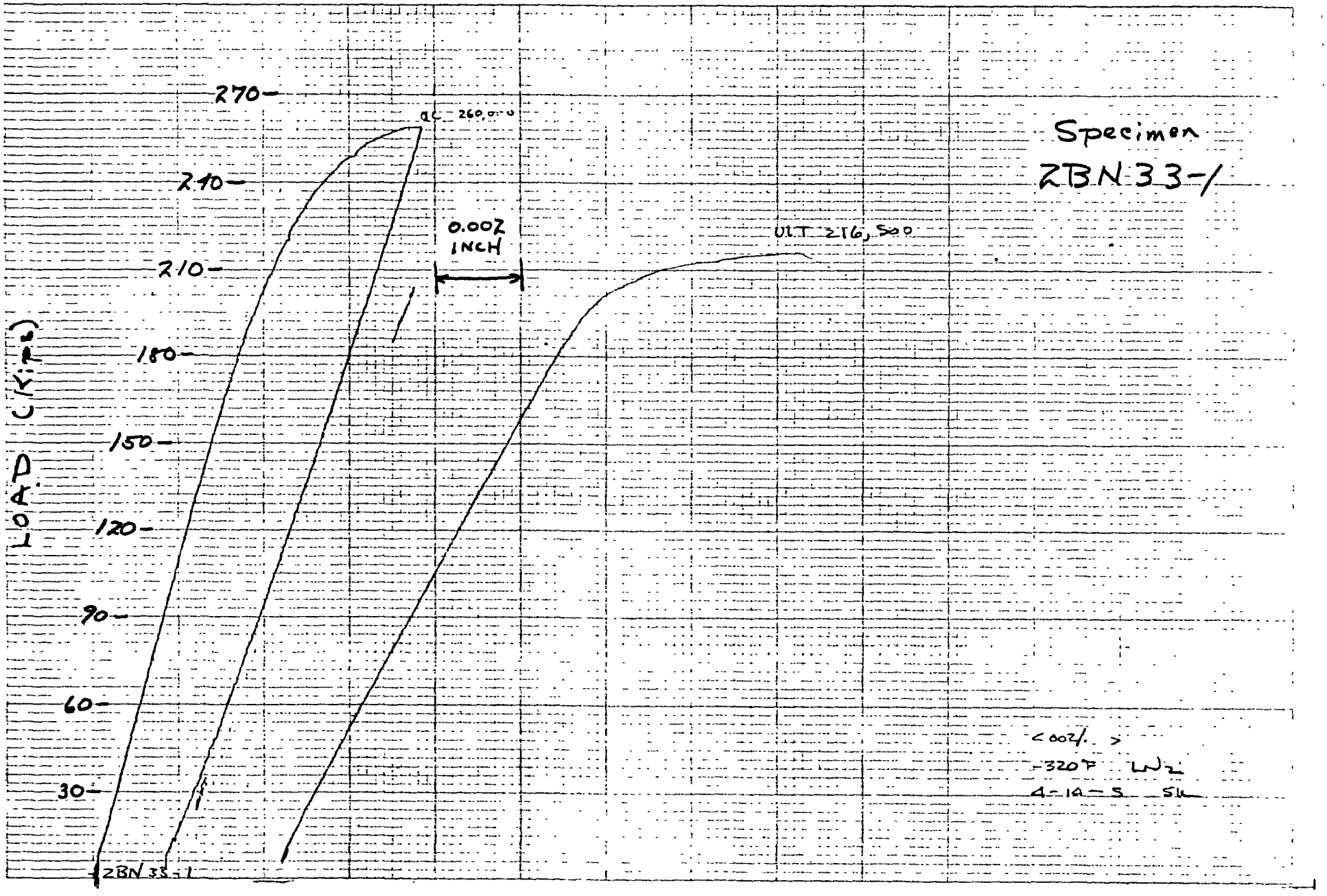

Specimen 2BN31-1
0.002 INCH
240
200
160
120
80
40
LOAD (Kips)
UCT 201,200 lbs
ELUL
← Fracture
2BN31-1
-320°F LN2

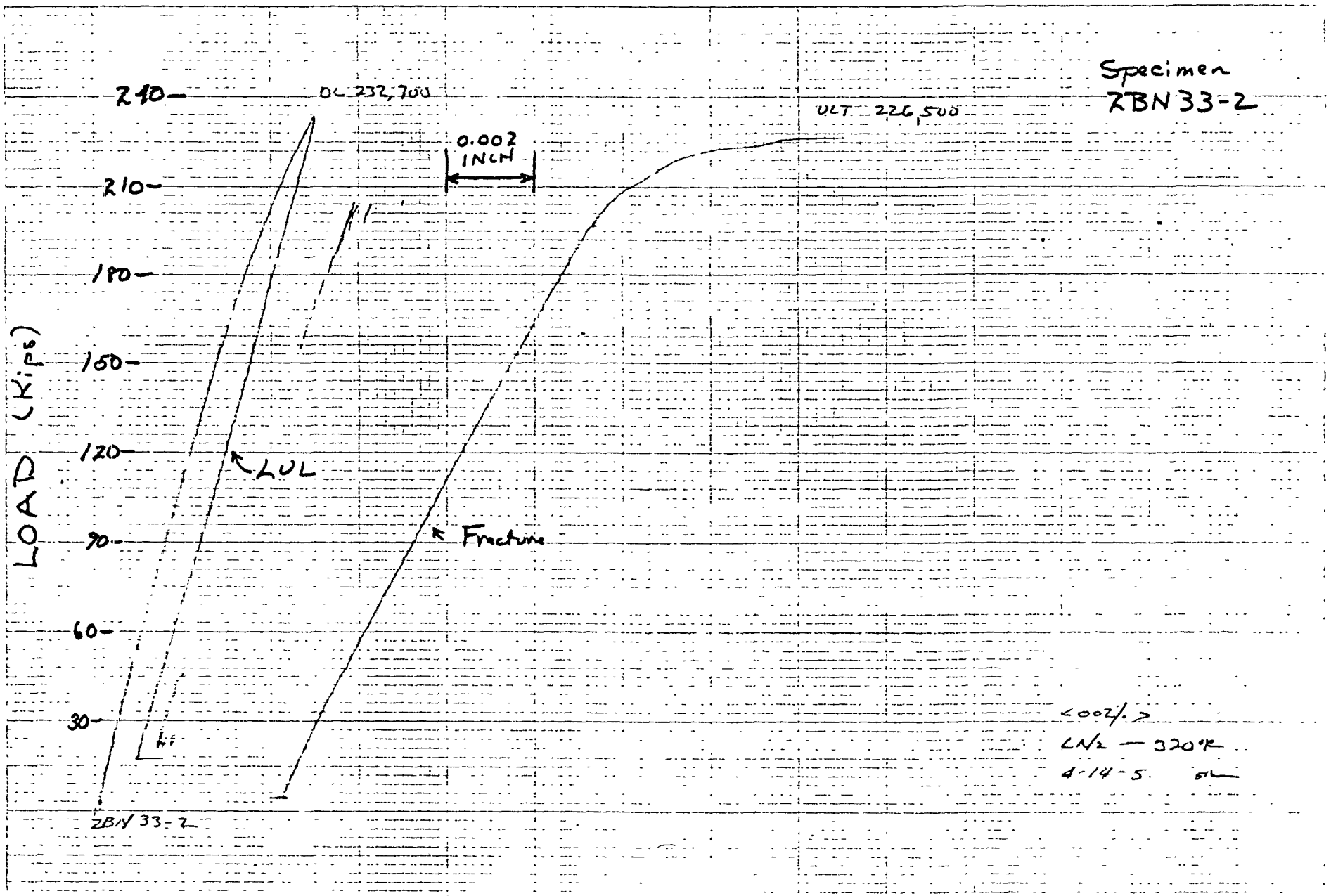

0.002
INCH
Specimen
3BN 31-1
280
240
200
160
120
80
40
LOAD (Kips)
← Fracture

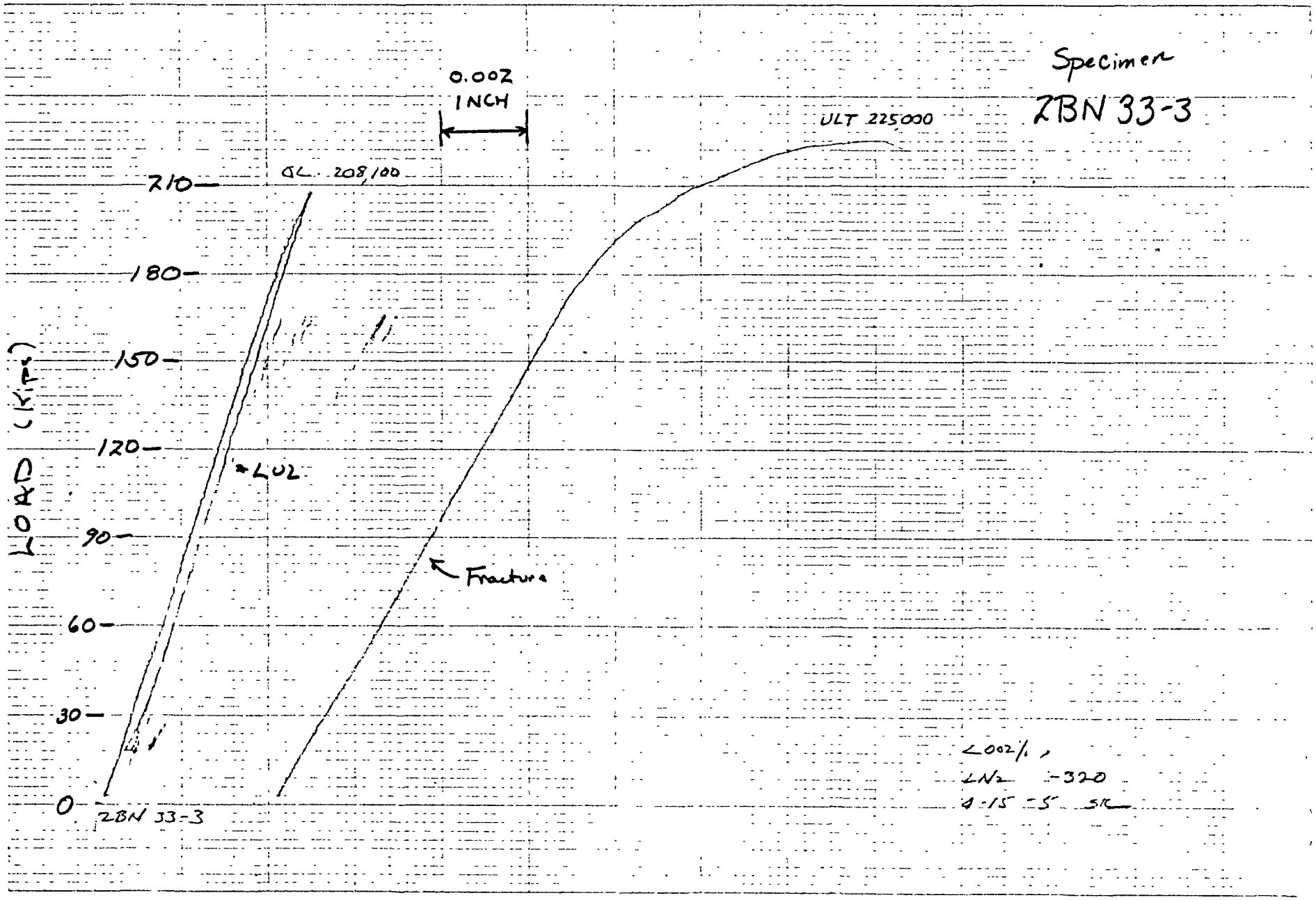

0.002 INCH
Specimen
3BN31-2
0.L. 251,200
ULT 201,600
e LUL
Fracture
LOAD (Kips)
280
240
200
160
120
80
40
3BN31-2
<.002" >
-320 in LVDT
-1.5 in

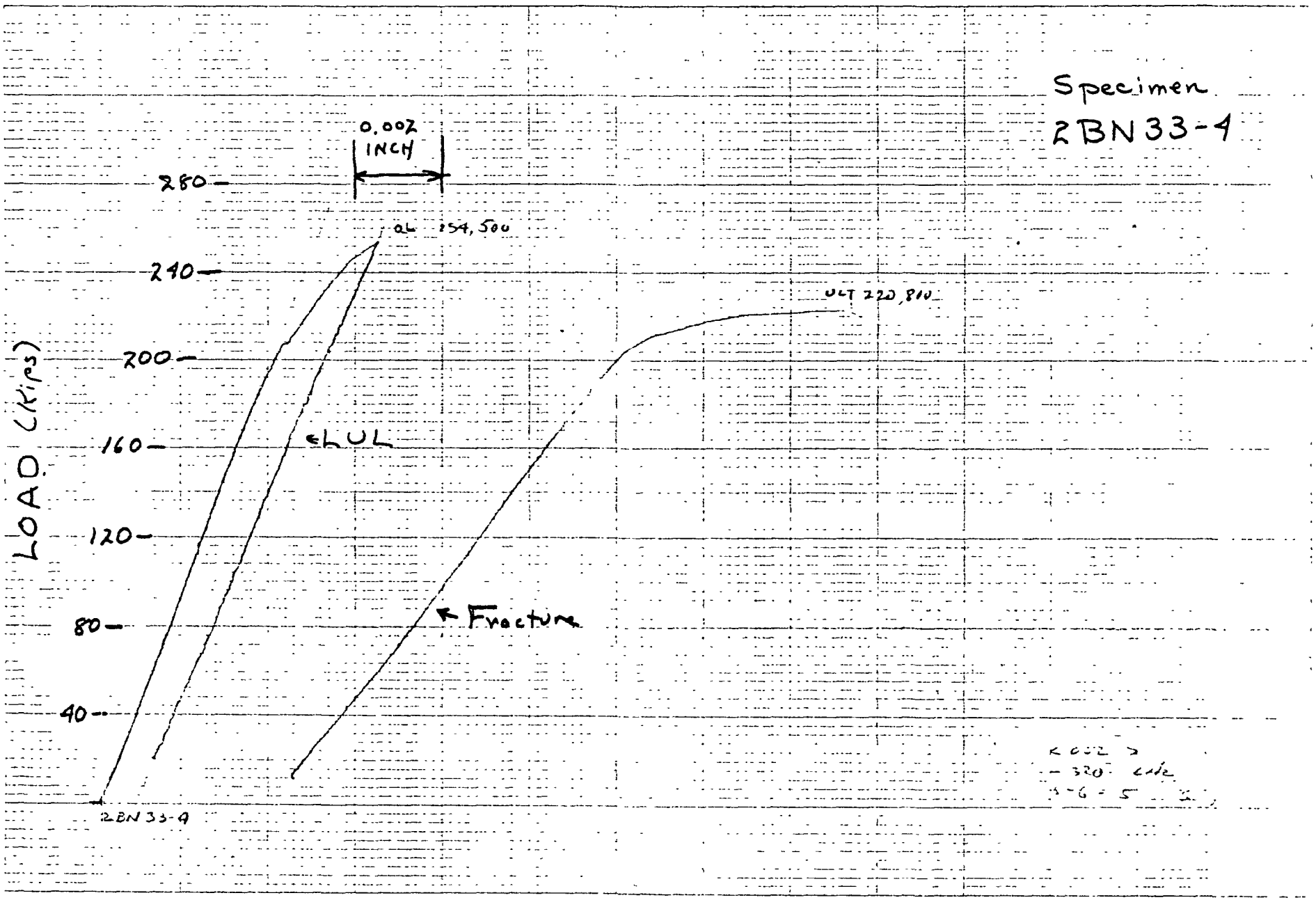

Specimen
4BN31-2
0.002
INCH
251,200
240
200
160
120
80
40
LOAD (KIPS)
FLUL
Fracture
4BN31-2

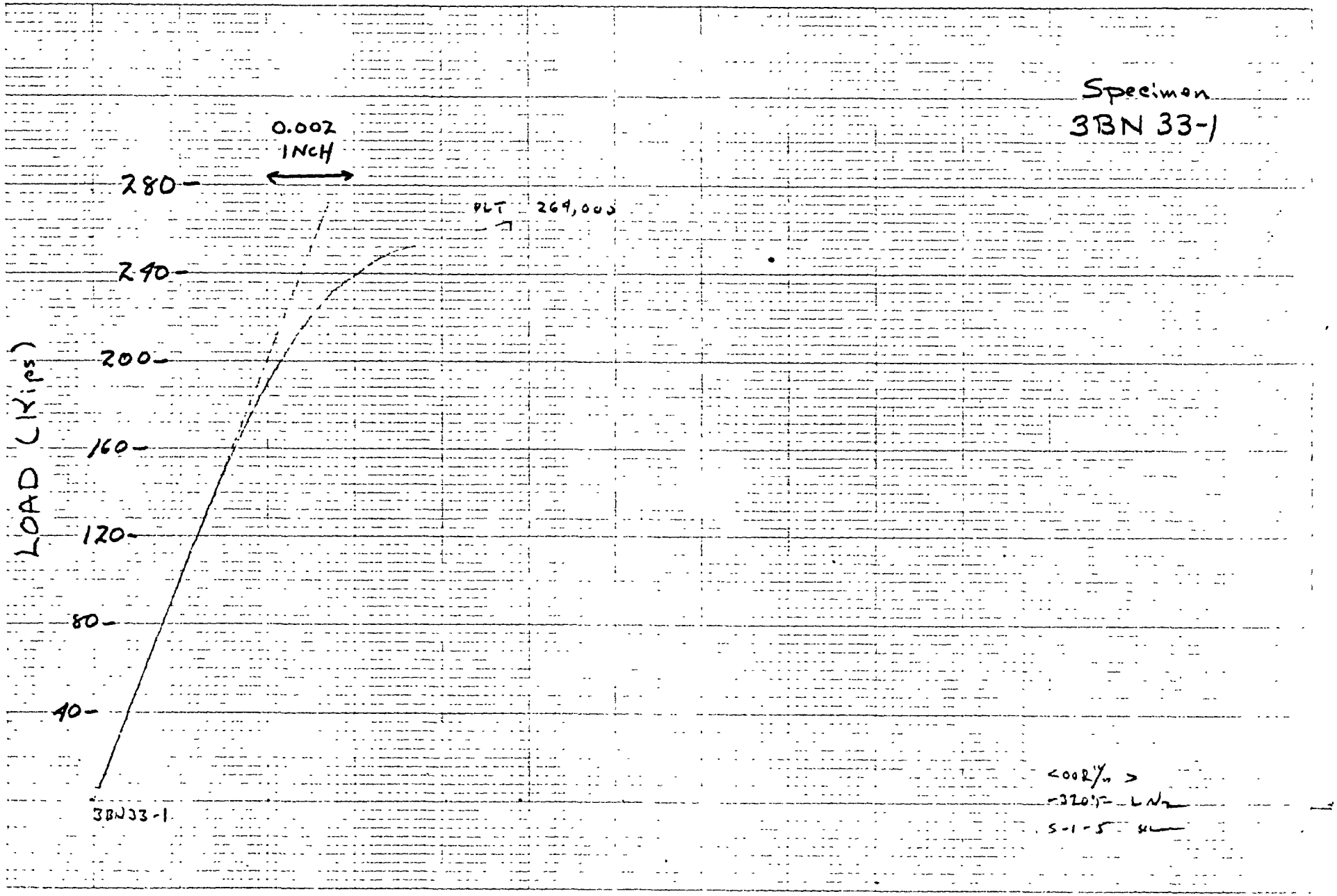

Specimen
4BN 31-3
0.002
INCH
280
240
200
160
120
80
40
LOAD (KIPS)
AUL
OL
Fracture
4BN 31-3

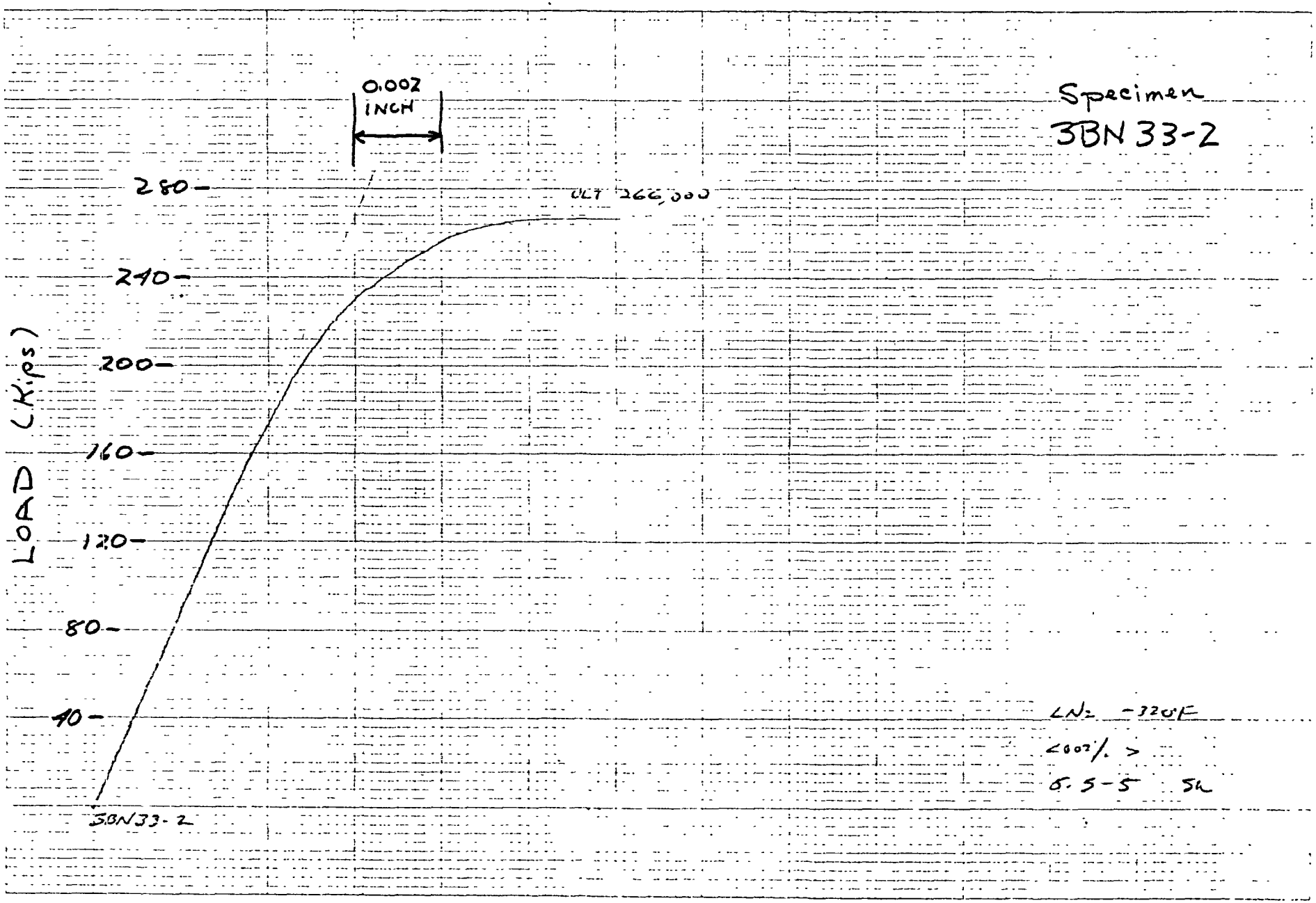

Specimen
2BN33-1
LOAD (KIPS)
270
240
210
180
150
120
90
60
30
0.002 INCH
ULT 216,500
2BN 33-1
<.002/. >
-320°F LN2
4-1A-5 5K

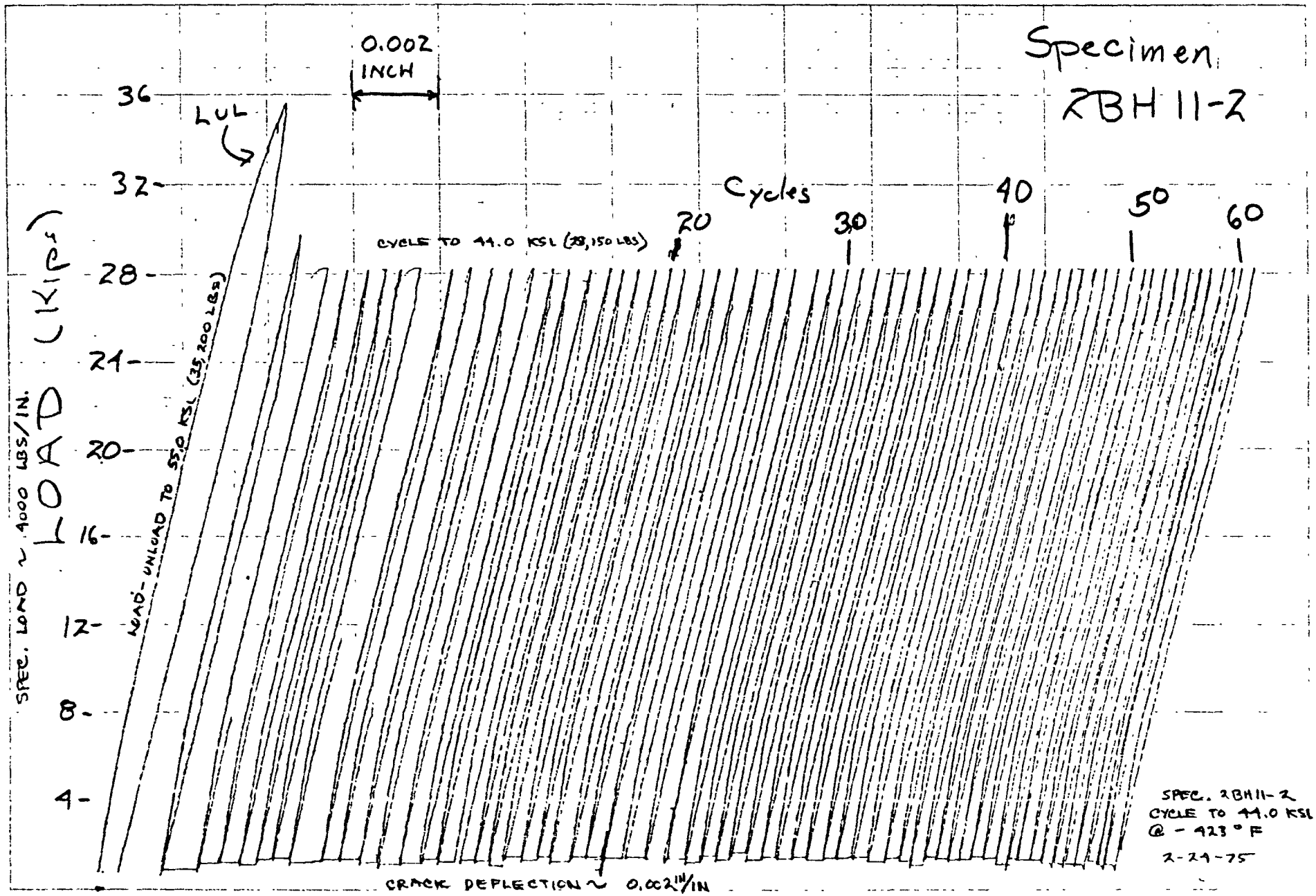

Specimen
ZBN33-2
240
210
180
150
120
90
60
30
LOAD (KIPS)
OL 232,700
ULT 226,500
0.002
INCH
LUL
Fracture
ZBN 33-2
<.002/.>
LN2 — 320°K
4-14-5

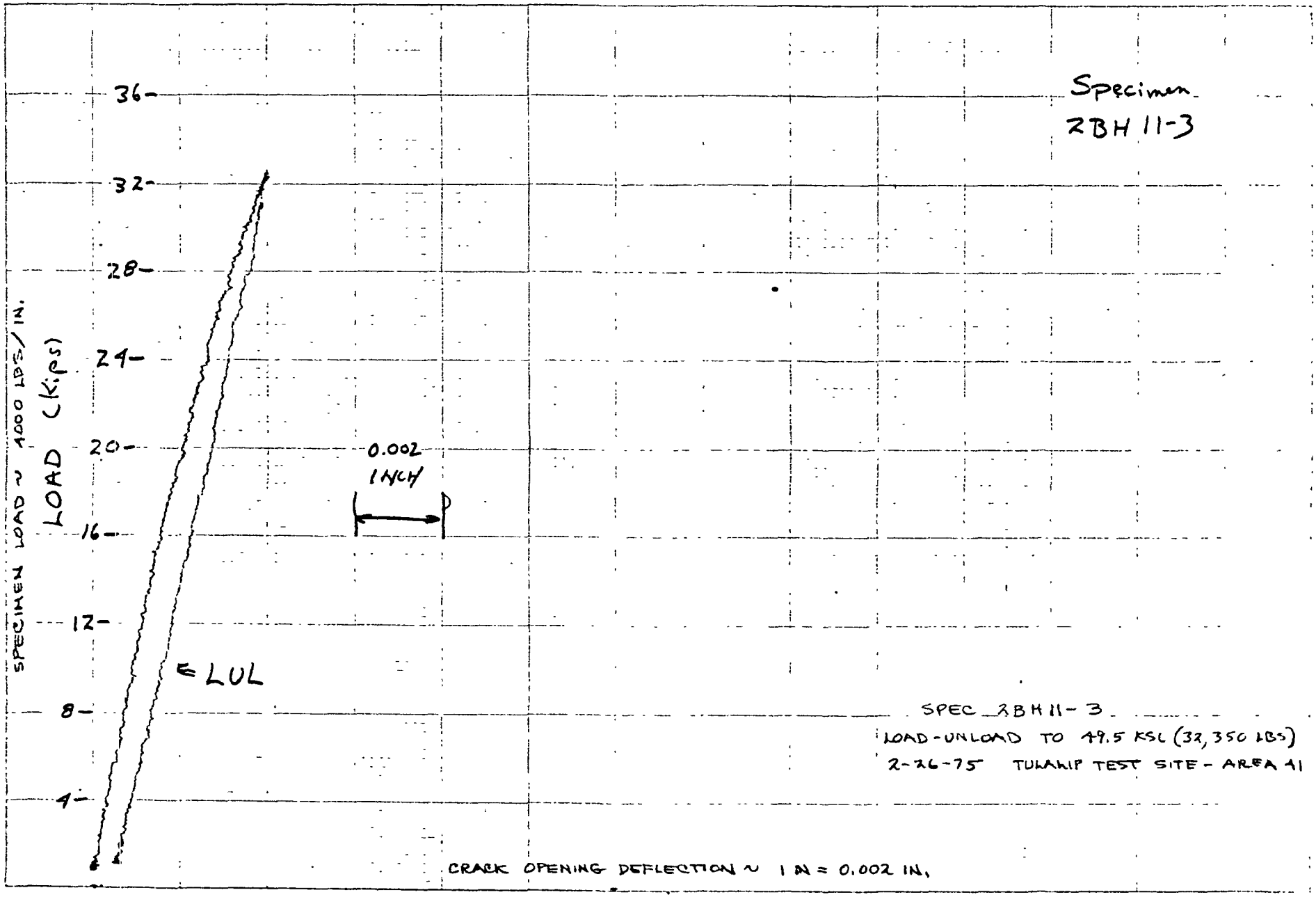

Specimen
ZBN 33-3
0.002
INCH
ULT 225000
GL. 208/100
210
180
150
120
90
60
30
0
LOAD (KIPS)
.2% OFFSET
Fracture
ZBN 33-3
<.002/1,
LN2 -320
1-15 -5 5R

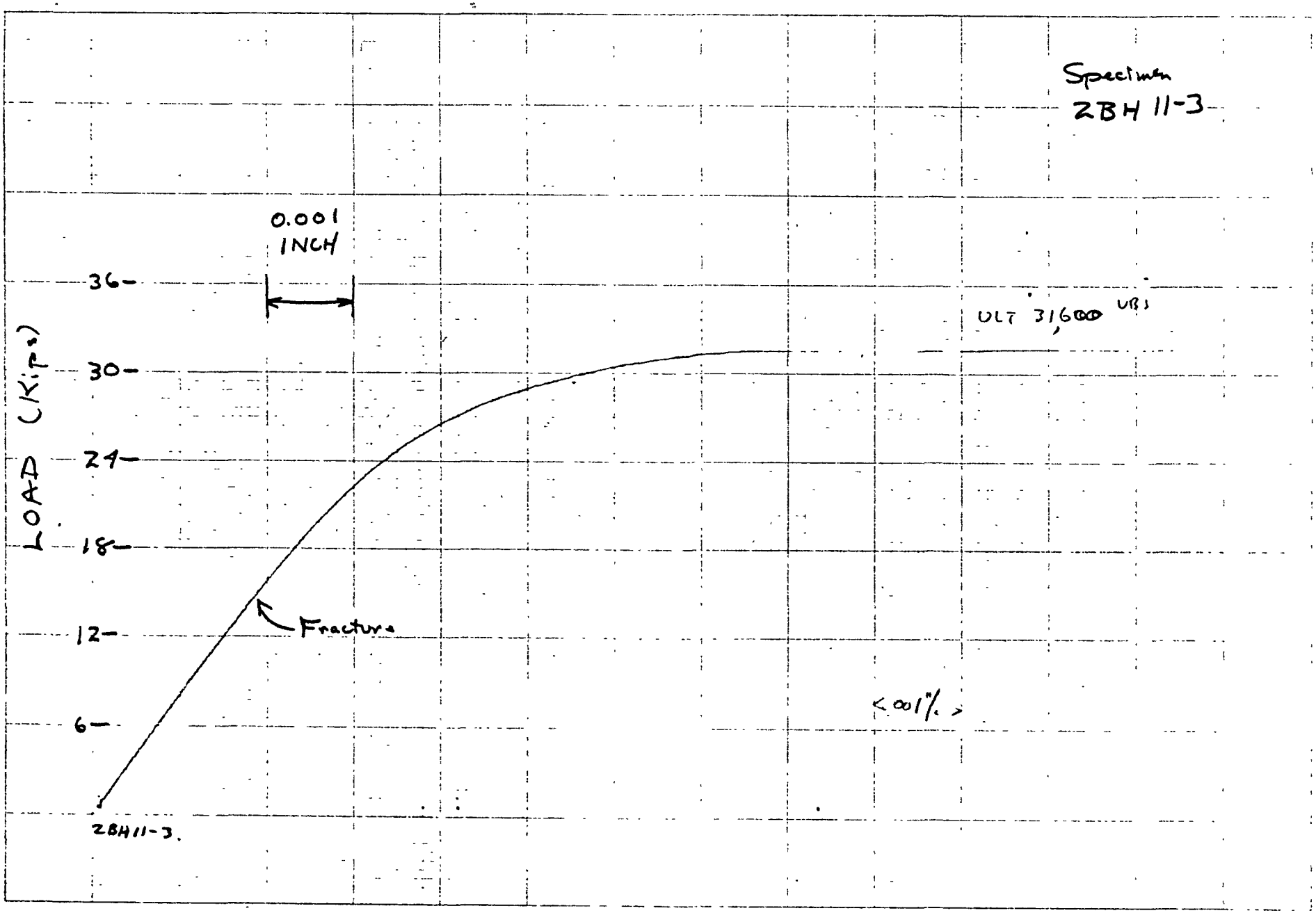

Specimen
2BN33-1
0.002
INCH
280
240
200
160
120
80
40
LOAD (Kips)
QL 154,500
ULT 220,810
←QUL
← Fracture
2BN33-A

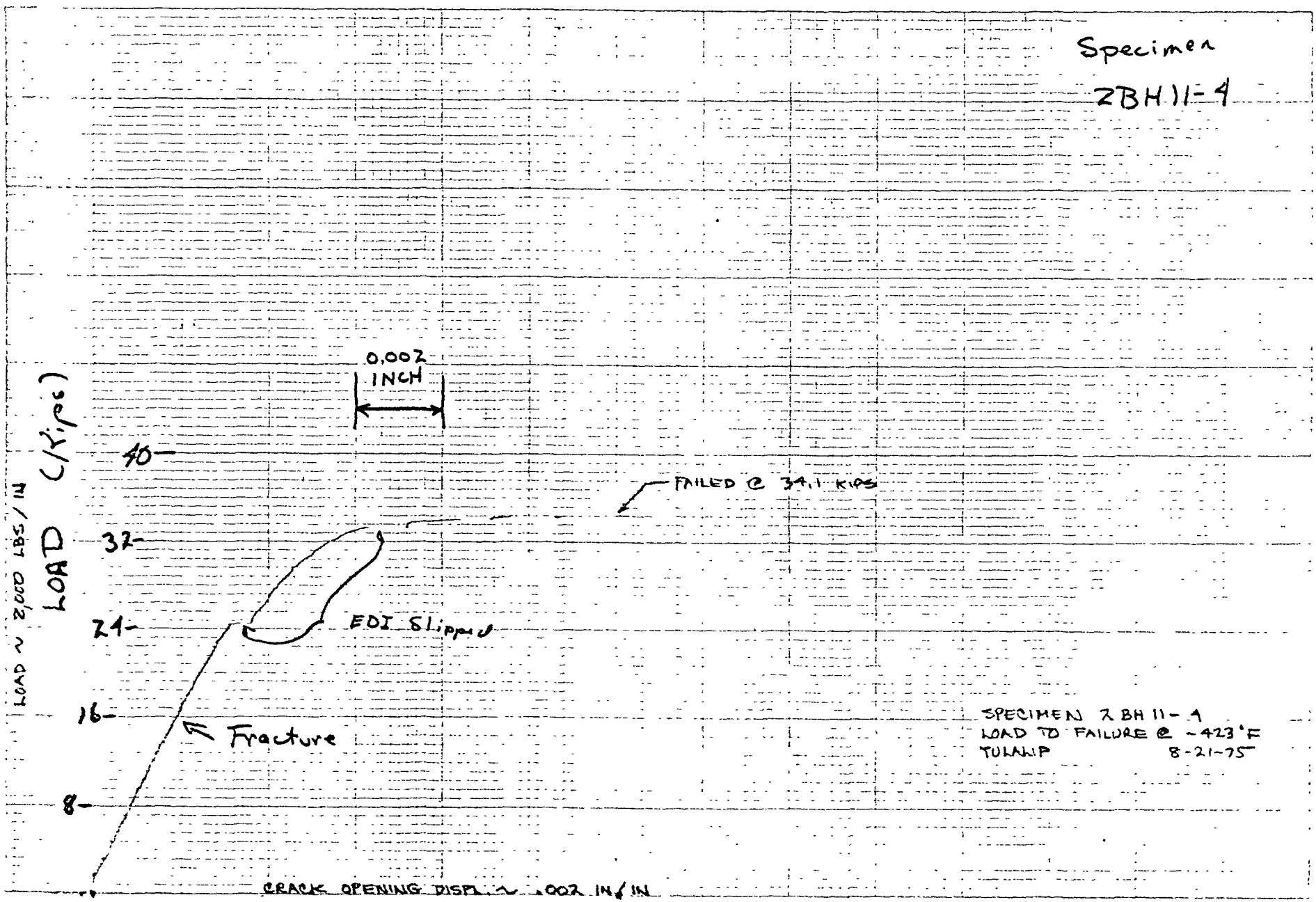

Specimen
3BN 33-1
0.002
INCH
280
240
200
160
120
80
40
LOAD (Kips)
PLT 269,000
3BN33-1
<00R'%>
-320°F LN2
S-1-5

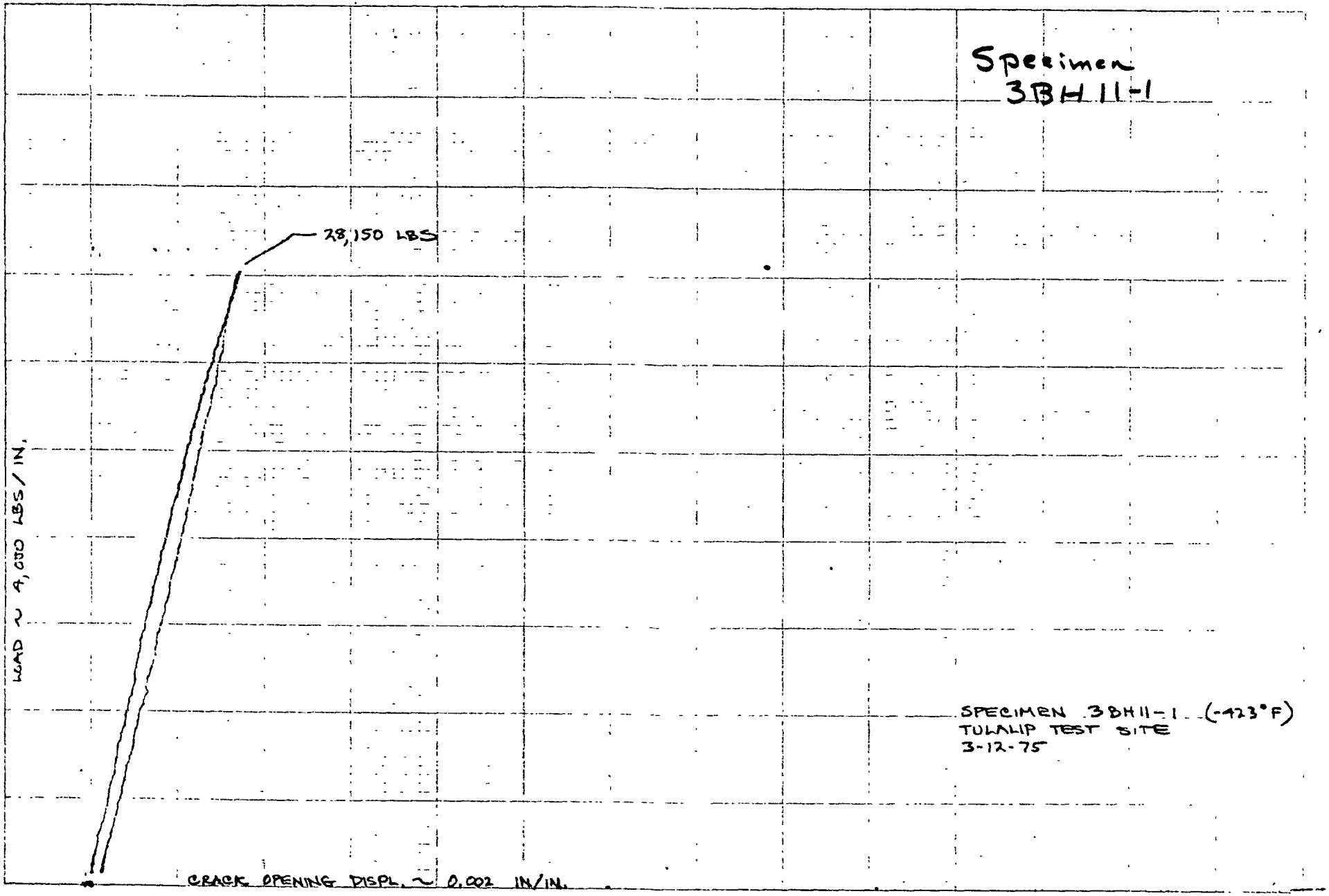

0.002 INCH
Specimen
3BN 33-2
280
240
200
160
120
80
40
LOAD (Kips)
ULT 266,000
3BN33-2
LN2 -320F
<.002% >
6.5-5 5K


Specimen
2BH11-2
0.002
INCH
LUL
Cycles
20
30
40
50
60
CYCLE TO 44.0 KSI (38,150 LBS)
LOAD (KIPS)
36
32
28
24
20
16
12
8
4
SPEC. LOAD ~ 4000 LBS/IN.
LOAD - UNLOAD TO 5.0 KSI (35,200 LBS)
CRACK DEFLECTION ~ 0.002"/IN
SPEC. 2BH11-2
CYCLE TO 44.0 KSI
@ - 423° F
2-24-75

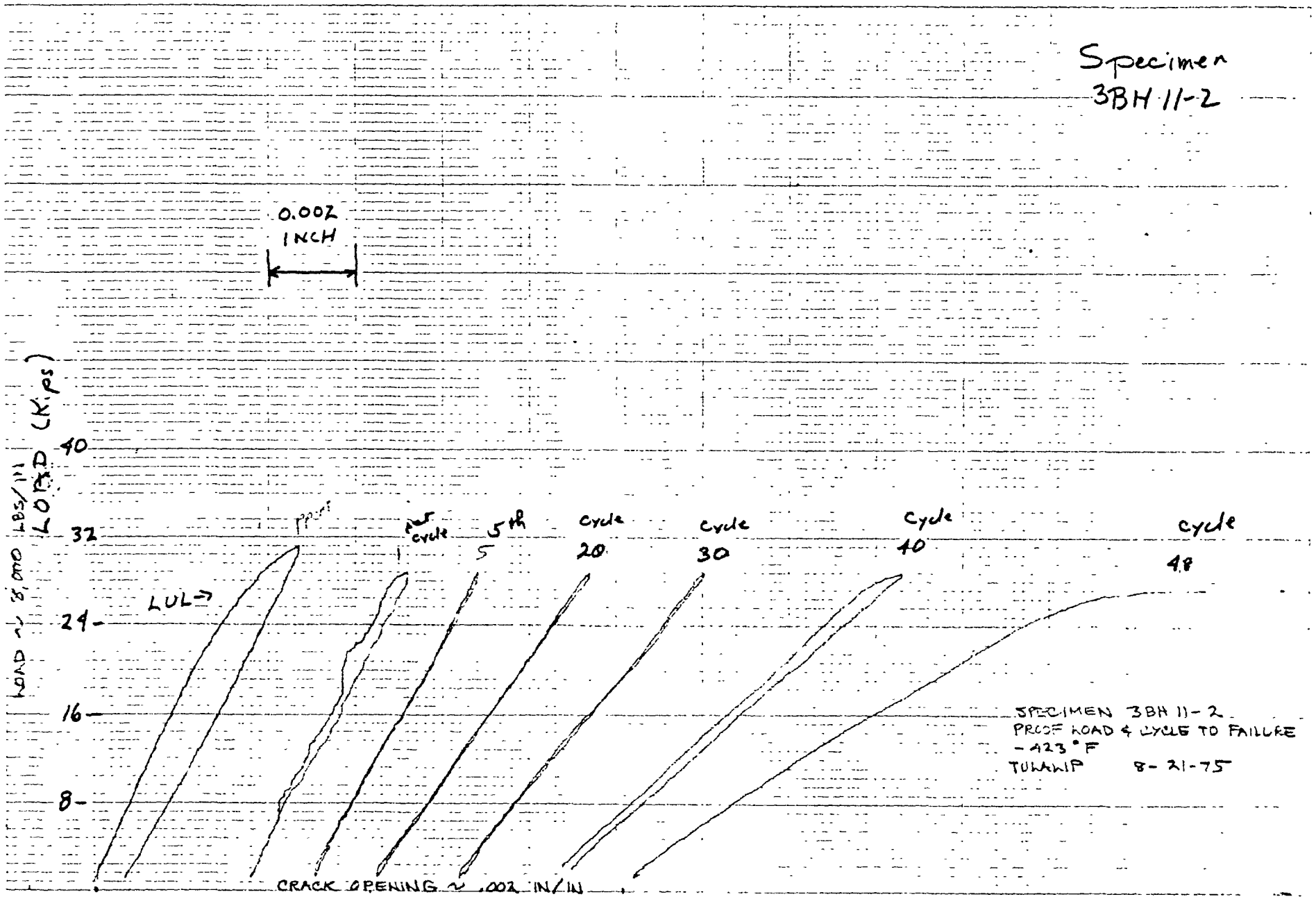

Specimen
2BH 11-3
36
32
28
24
20
16
12
8
4
LOAD (Kips)
SPECIMEN LOAD ~ 1000 LBS/IN.
0.002
INCH
LUL
SPEC 2BH 11-3
LOAD-UNLOAD TO 49.5 KSI (32,350 LBS)
2-26-75 TULALIP TEST SITE - AREA 1
CRACK OPENING DEFLECTION ~ 1 IN = 0.002 IN.


Specimen
2BH 11-3
0.001
INCH
36
30
24
18
12
6
LOAD (Kips)
ULT 31,600 UBS
Fracture
<.001"/.>
2BH11-3.


Specimen
2BH11-4
0.002
INCH
LOAD (Kips)
LOAD ~ 2,000 LBS / IN
40
32
24
16
8
FAILED @ 34.1 KIPS
EDI Slipped
Fracture
SPECIMEN 2 BH 11-4
LOAD TO FAILURE @ -423°F
TULALIP 8-21-75
CRACK OPENING DISPL. ~ .002 IN / IN

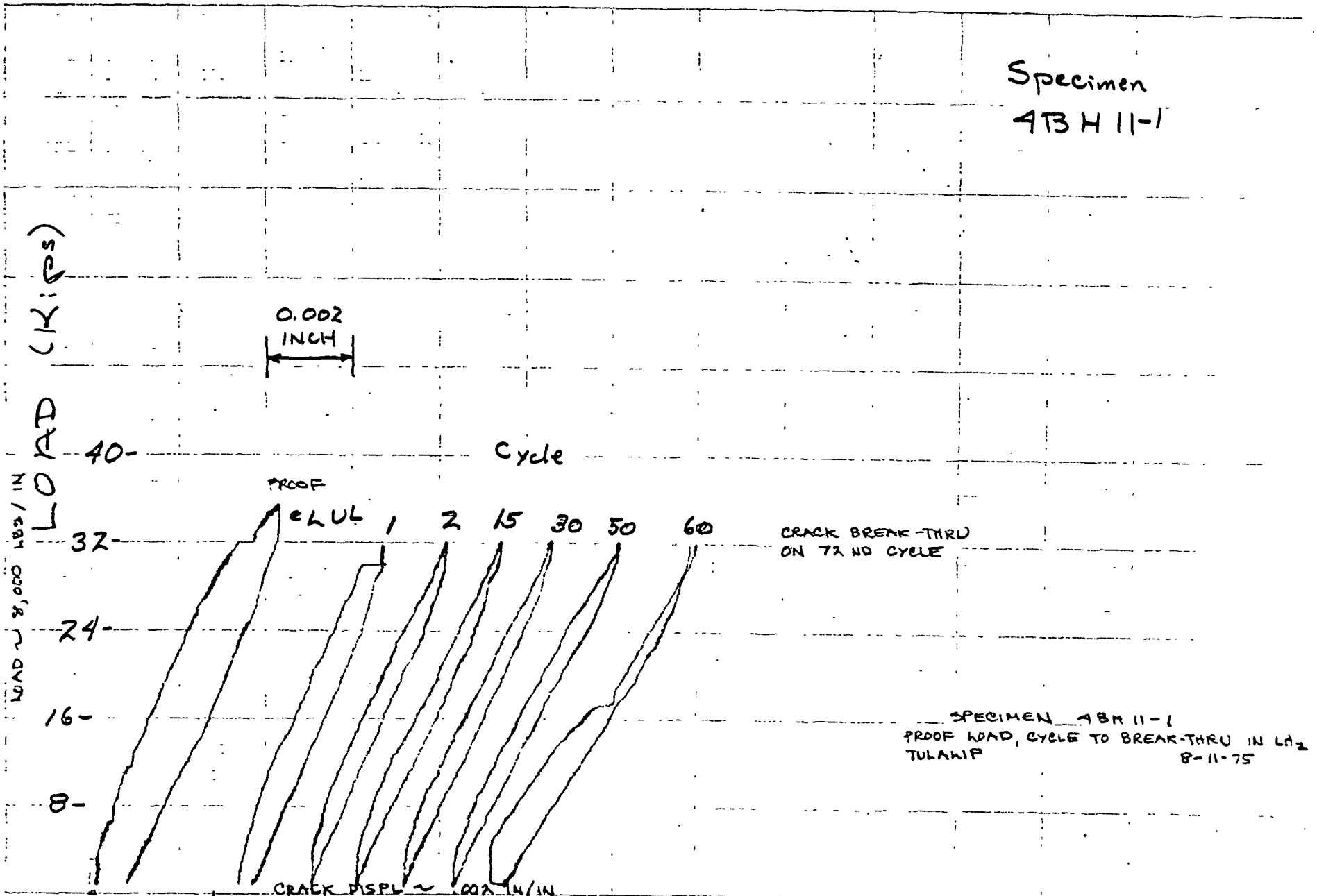


3-12-75 3BH11-1

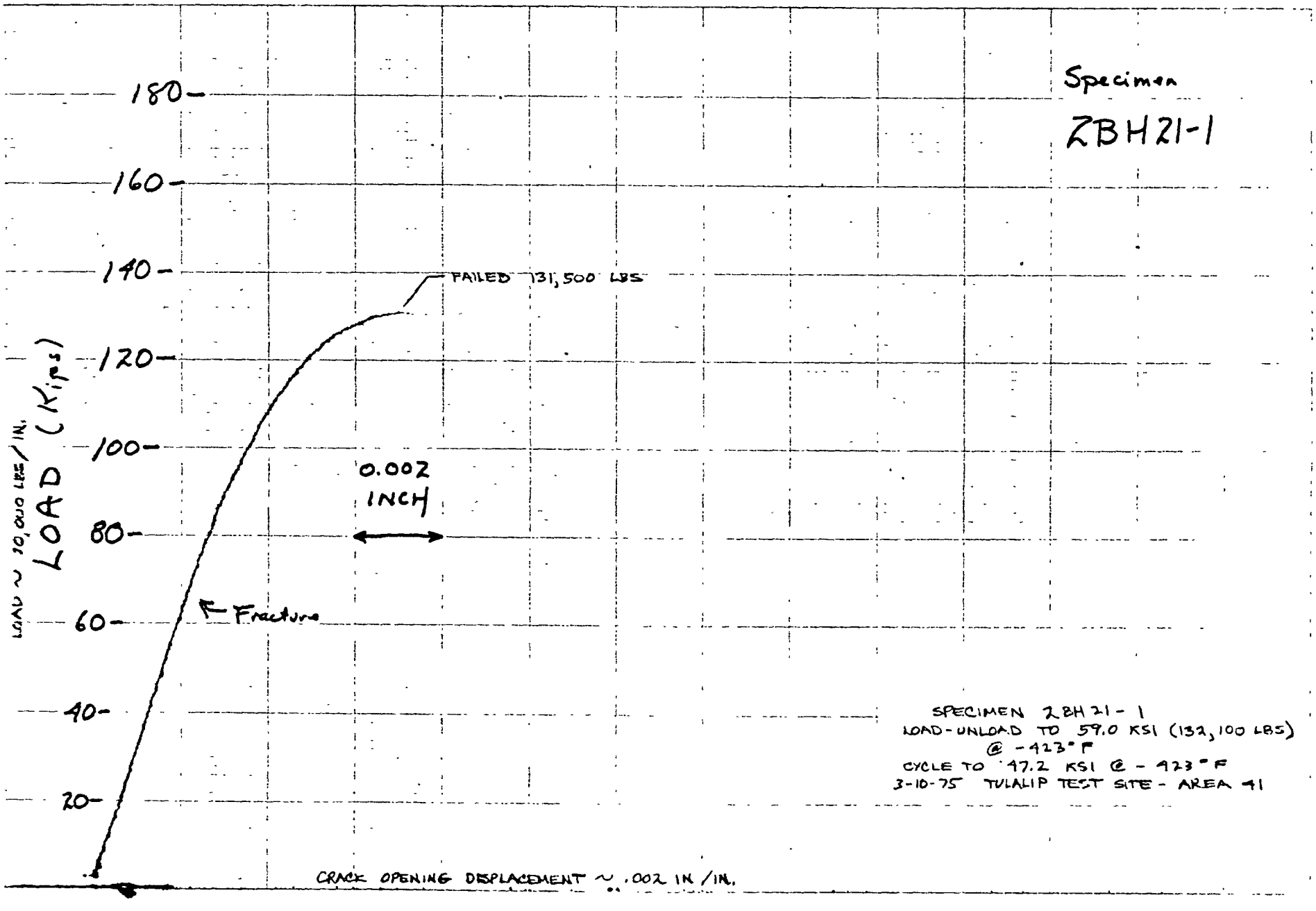

Specimen
3BH 11-2
0.002
INCH
LOAD (Kips)
LOAD ~ 8,000 LBS/in
40
32
24
16
8
LUL→
Proof
1st cycle
5th
5
cycle
20
cycle
30
cycle
40
cycle
48
CRACK OPENING ~ .002 IN/IN
SPECIMEN 3BH 11-2
PROOF LOAD & CYCLE TO FAILURE
-423°F
TULAHIP 8-21-75

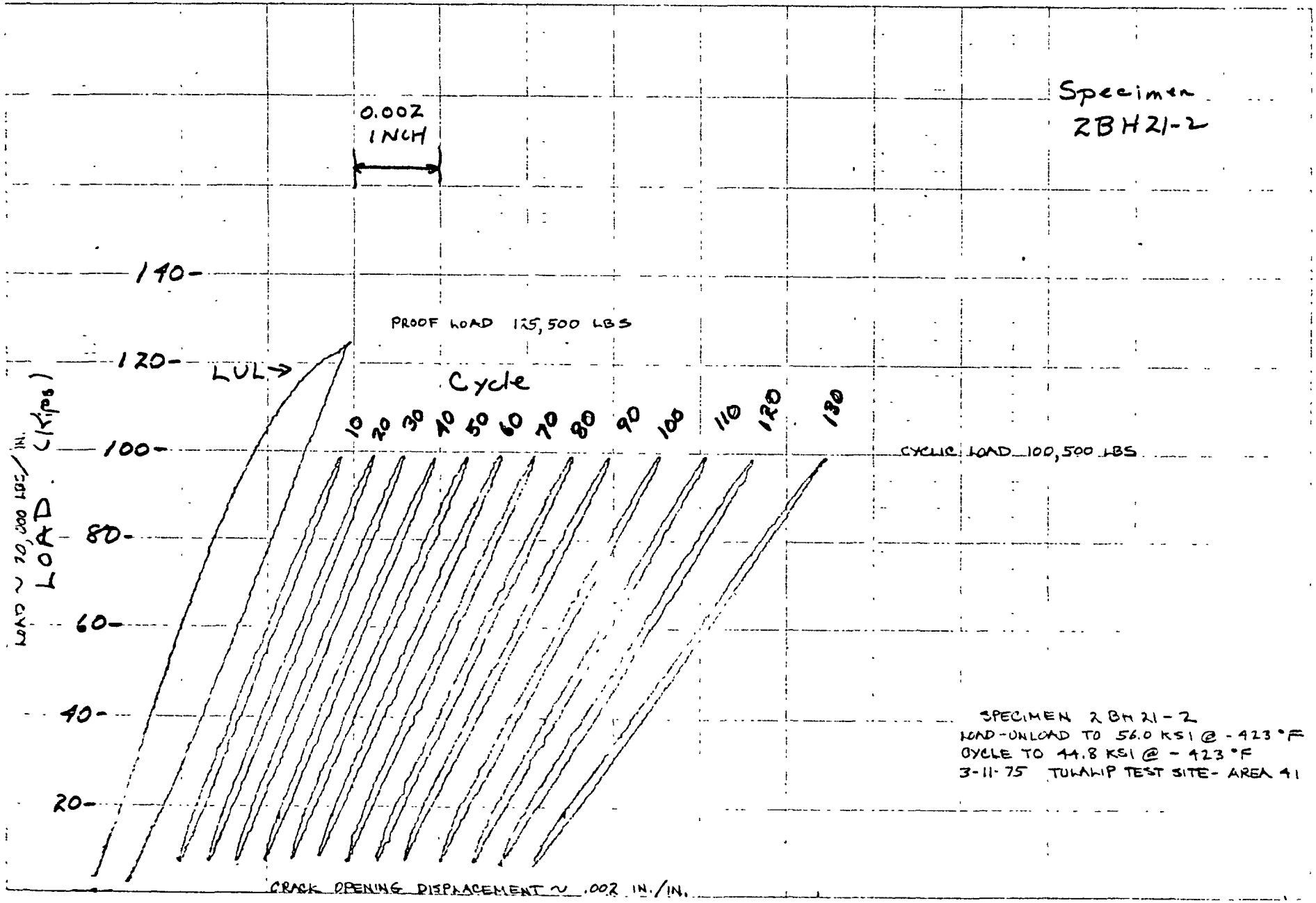
4BH11-1 8-11-75

Specimen
4B H 11-1

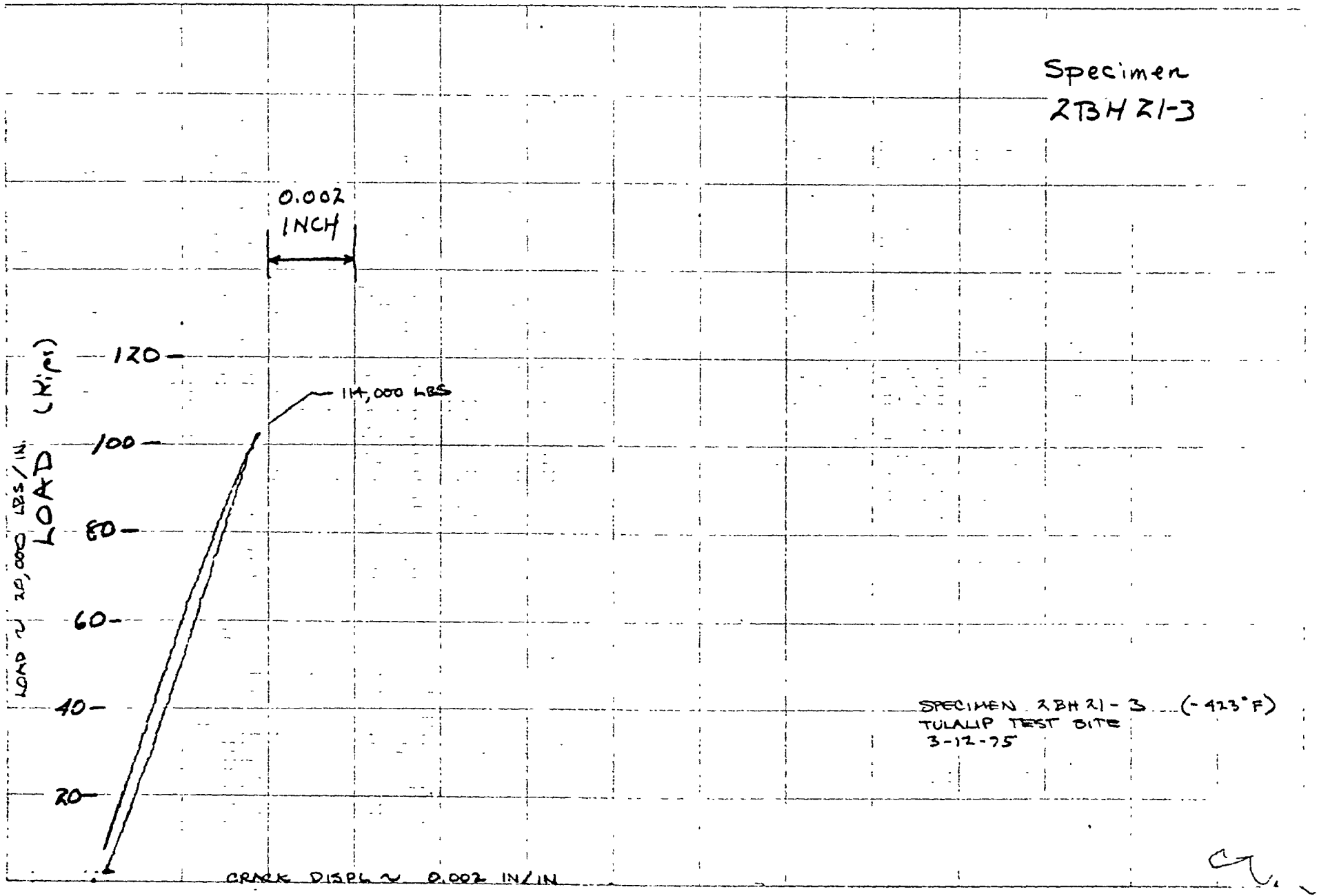


SPECIMEN 4BH 11-1
PROOF LOAD, CYCLE TO BREAK-THRU IN LH_2
TULAHIP 8-11-75


Specimen
ZBH21-1
180
160
140
120
100
80
60
40
20
LOAD (Kips)
LOAD ~ 10,000 LBS / IN.
FAILED 131,500 LBS
0.002
INCH
Fracture
CRACK OPENING DISPLACEMENT ~ .002 IN / IN.
SPECIMEN ZBH21-1
LOAD-UNLOAD TO 59.0 KSI (132,100 LBS)
@ -423°F
CYCLE TO 47.2 KSI @ -423°F
3-10-75 TULALIP TEST SITE - AREA 41


Specimen
2BH21-2
0.002
INCH
140
120
100
80
60
40
20
PROOF LOAD 125,500 LBS
LUL
Cycle
10 20 30 40 50 60 70 80 90 100 110 120 130
CYCLIC LOAD 100,500 LBS
LOAD ~ 20,000 LBS/IN.
LOAD (Kips)
SPECIMEN 2BH21-2
LOAD-UNLOAD TO 56.0 KSI @ -423°F
CYCLE TO 44.8 KSI @ -423°F
3-11-75 TULALIP TEST SITE- AREA 41
CRACK OPENING DISPLACEMENT ~ .002 IN./IN.

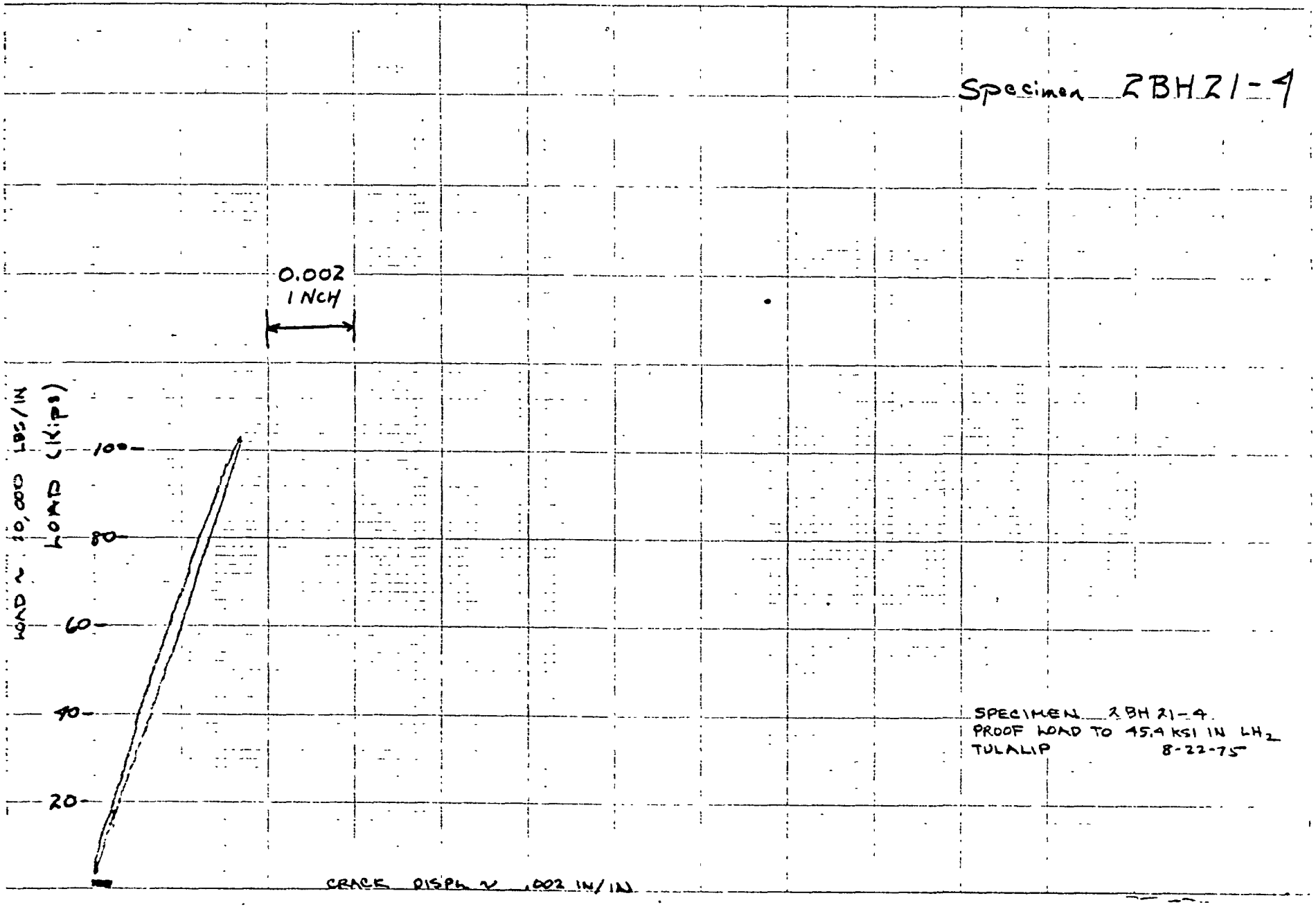
Specimen
2TBH21-3



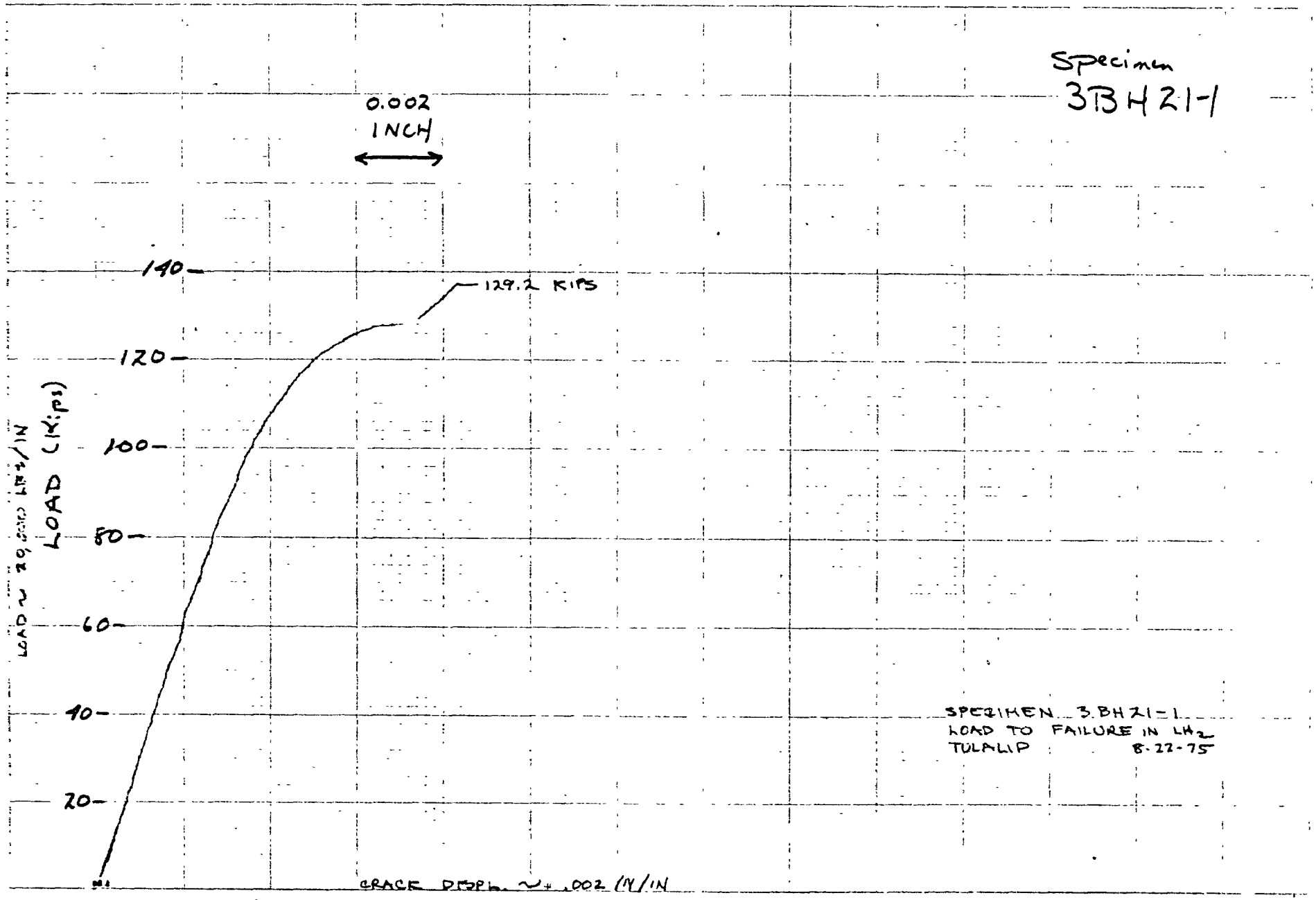
SPECIMEN 2BH21-3 (-423°F)
TULALIP TEST SITE
3-12-75

2T 21 3 3-12-75

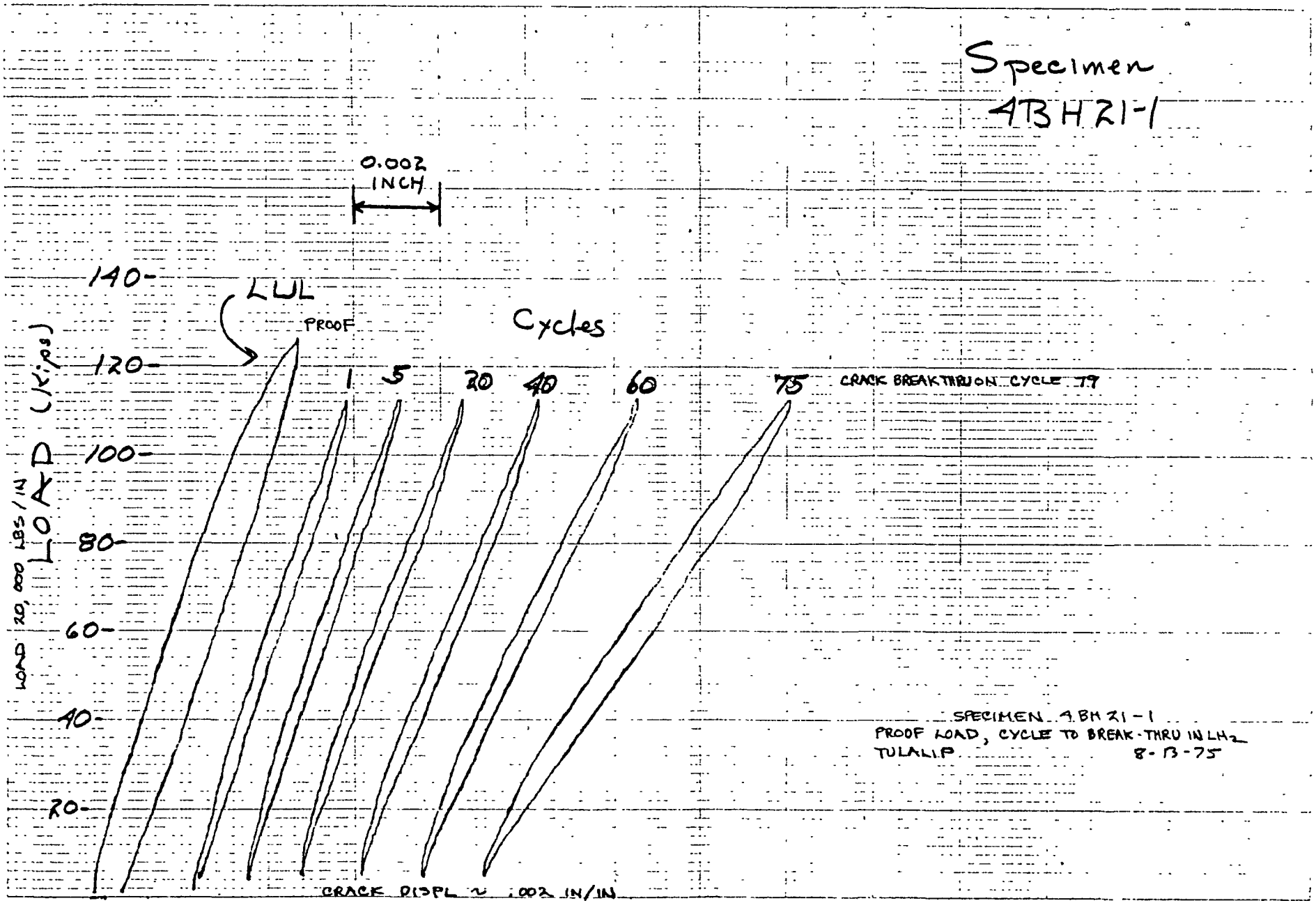
Specimen 2BH21-4

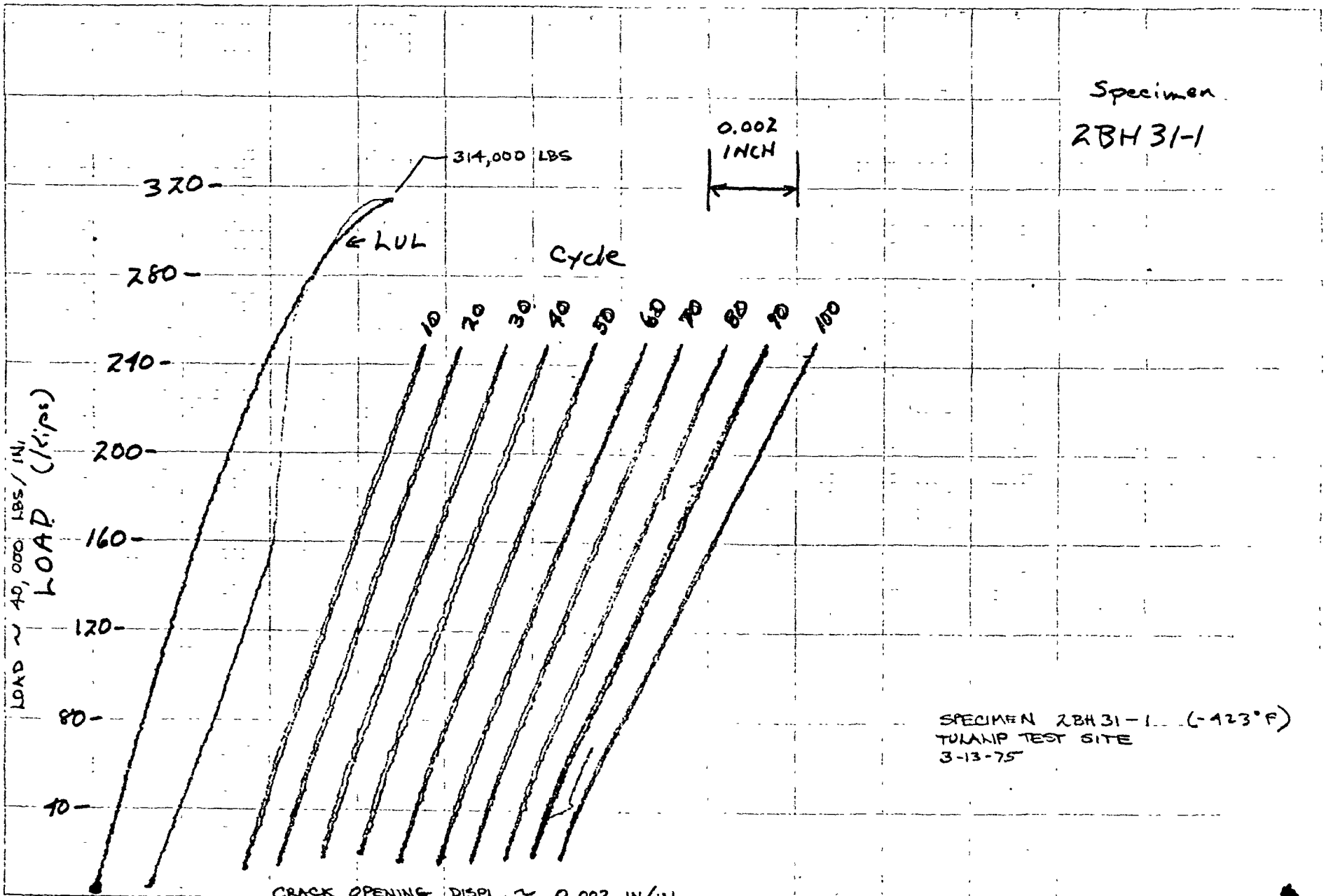


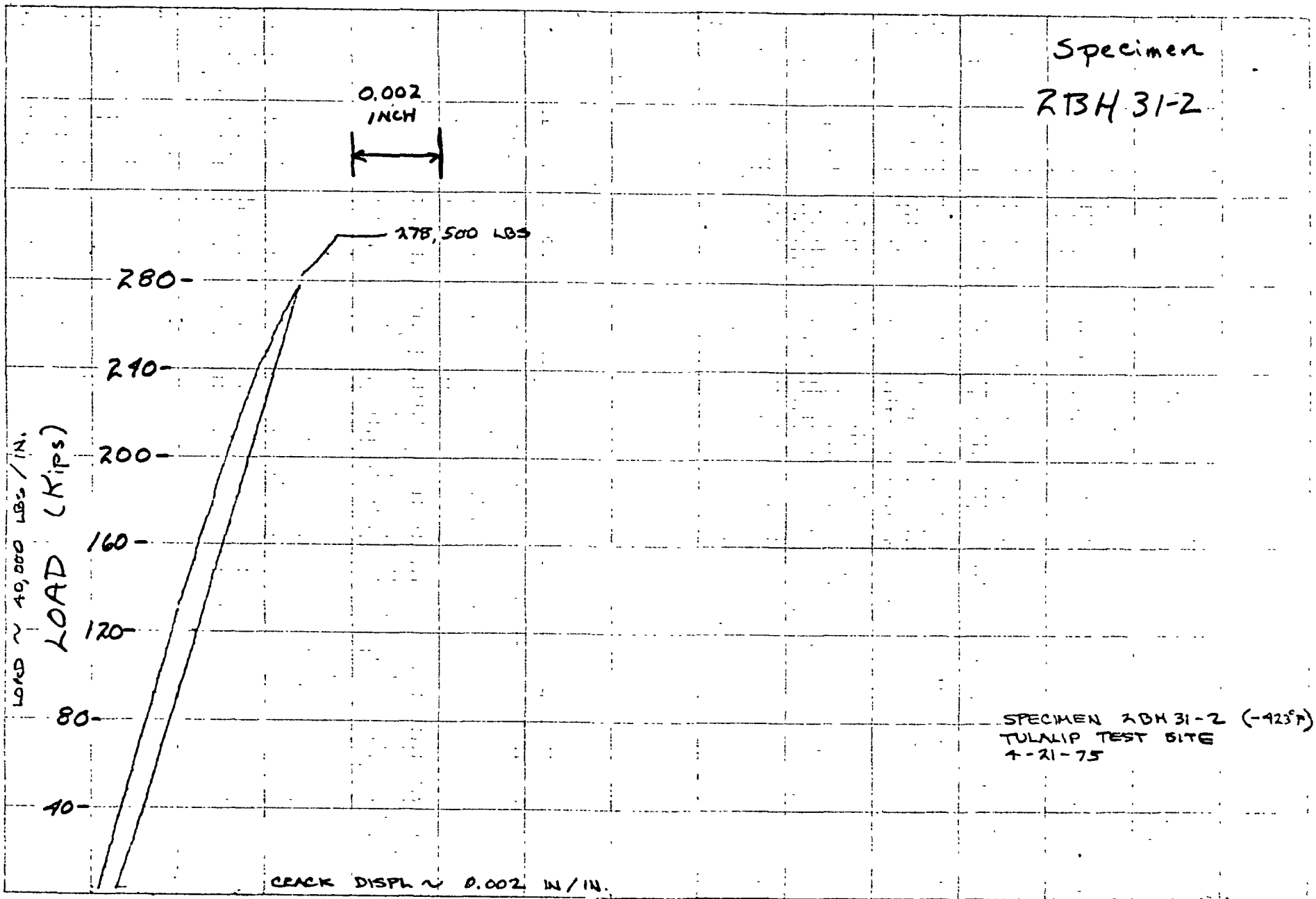
SPECIMEN 2BH 21-4.
PROOF LOAD TO 45.4 KSI IN LH_2
TULALIP 8-22-75

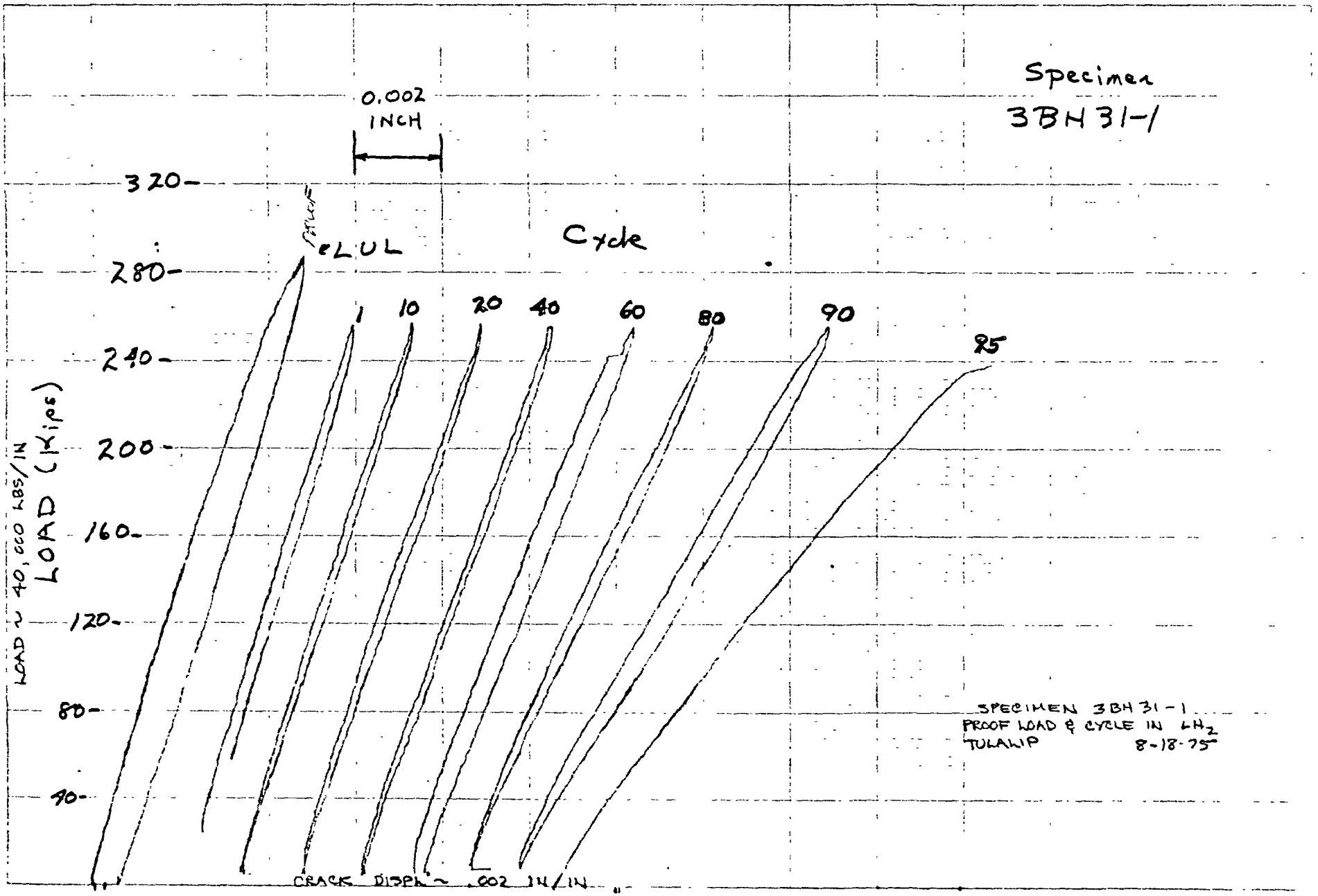

Specimen
3TBH21-1
0.002
INCH
140
120
100
80
60
40
20
129.2 KIPS
LOAD (Kips)
LOAD ~ 20,000 LBS/IN
GRACE DISPL. ~ .002 IN/IN
SPECIMEN 3.BH21-1
LOAD TO FAILURE IN LH2
TULALIP
8-22-75

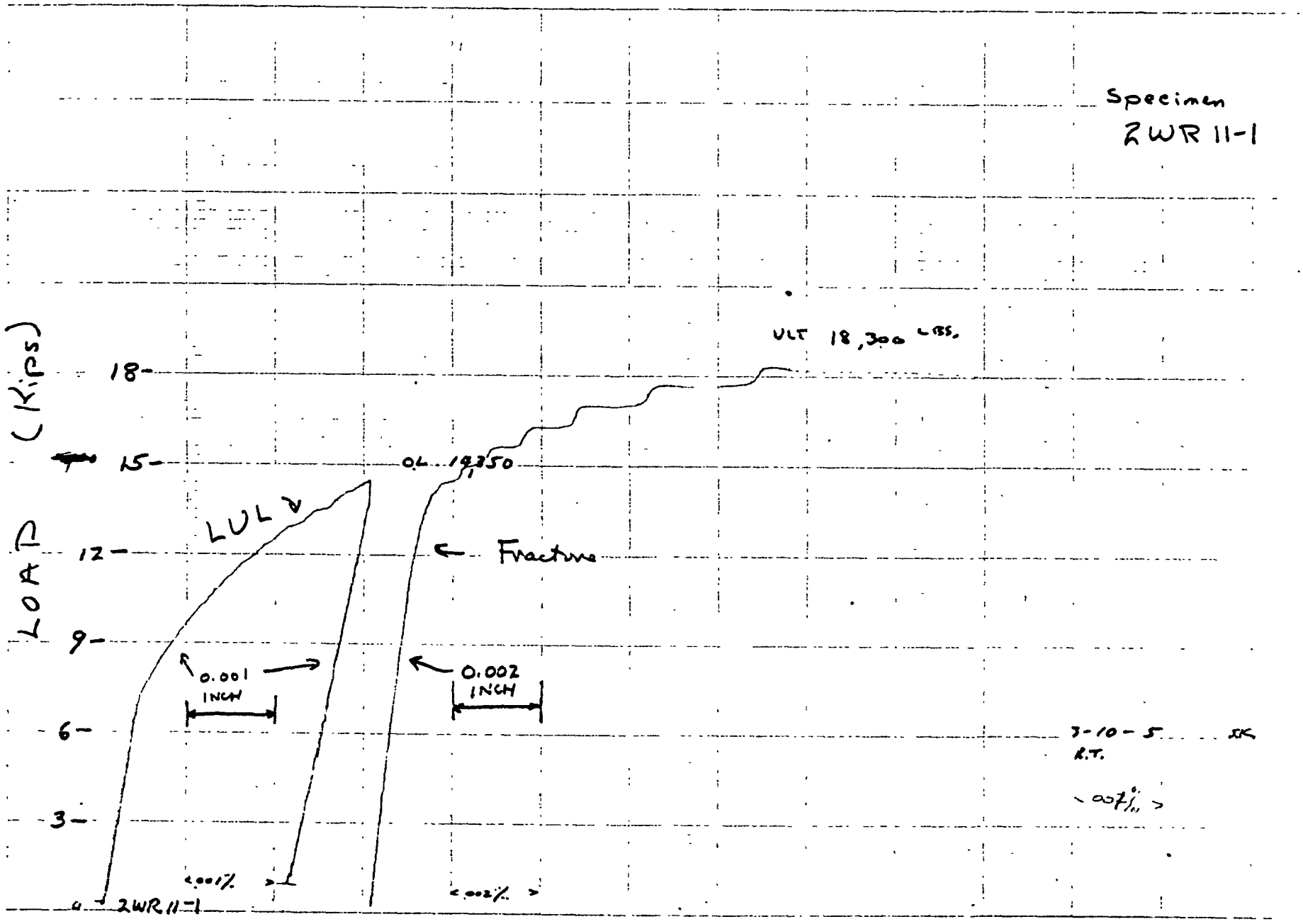
4BH21-1

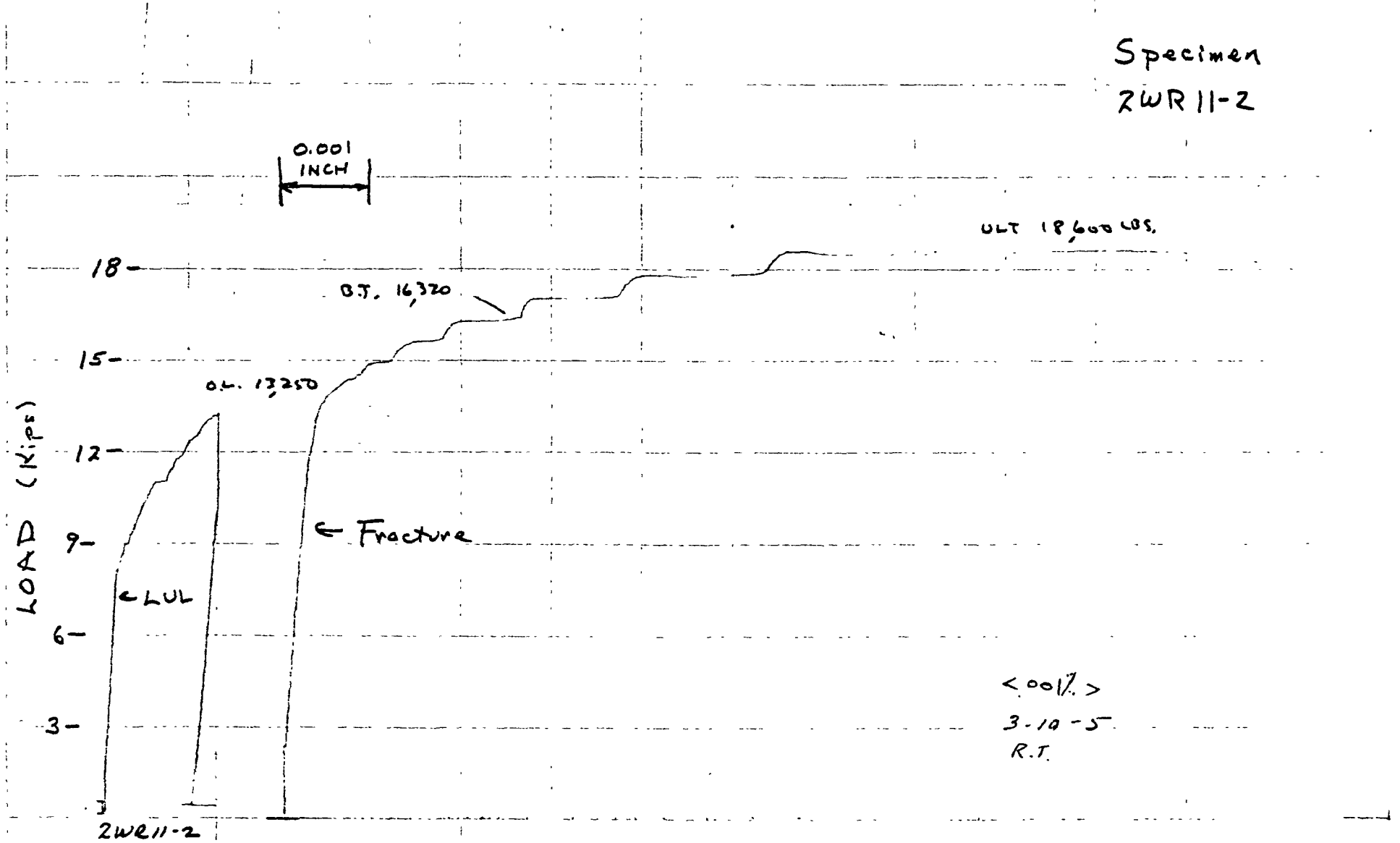

Specimen
4BH21-1
0.002
INCH
140
120
100
80
60
40
20
LOAD (Kips)
LOAD 20,000 LBS/IN
LUL
PROOF
Cycles
1
5
20
40
60
75
CRACK BREAKTHRU ON CYCLE 79
CRACK DISPL ~ .002 IN/IN
SPECIMEN 4BH21-1
PROOF LOAD, CYCLE TO BREAK-THRU IN LH2
TULALIP
8-13-75

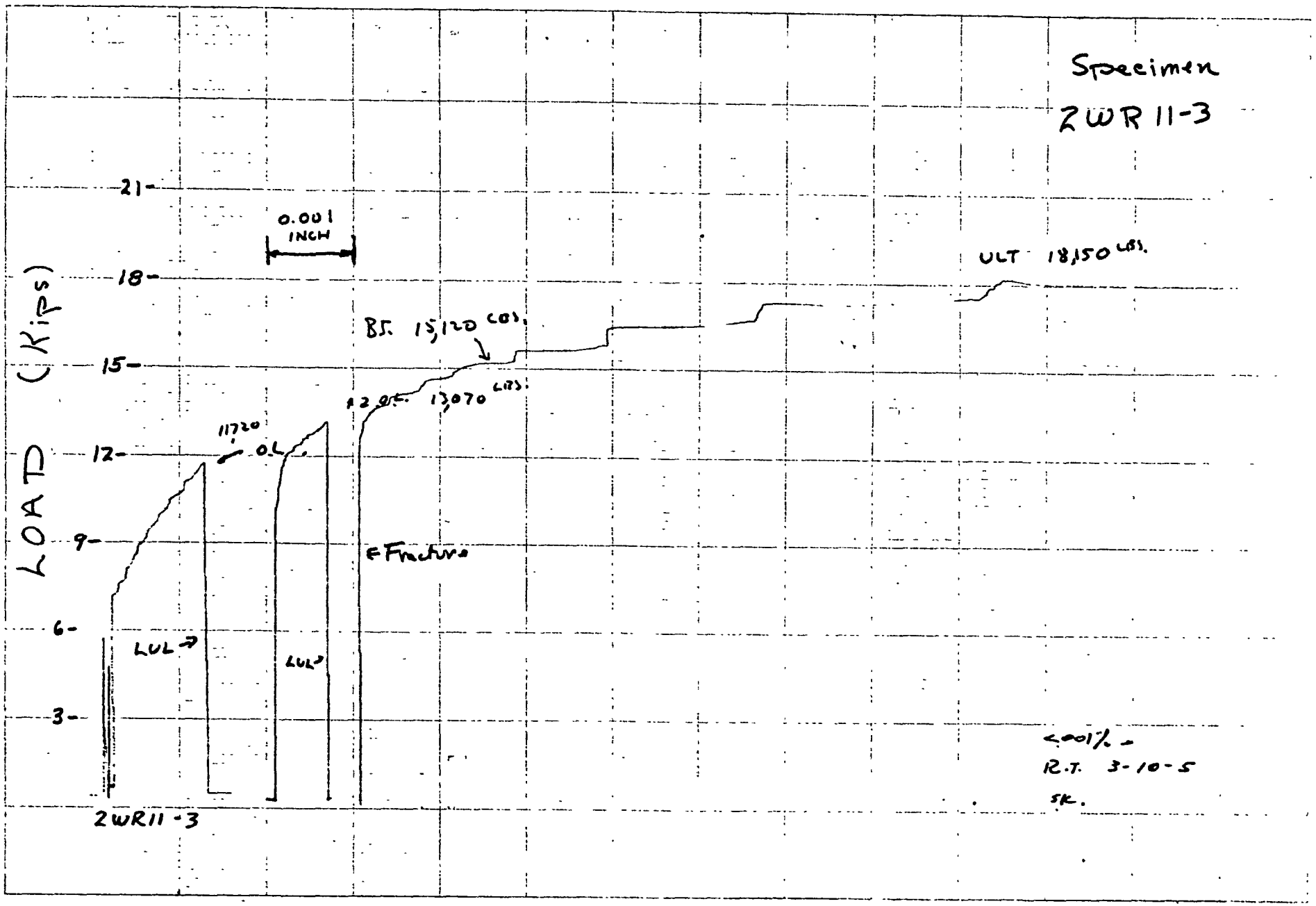

Specimen
2BH31-1
0.002
INCH
314,000 LBS
LUL
Cycle
10
20
30
40
50
60
70
80
90
100
320
280
240
200
160
120
80
40
LOAD ~ 40,000 LBS/IN.
LOAD (kips)
CRACK OPENING DISPL. ~ 0.002 IN/IN
SPECIMEN 2BH31-1 (-423°F)
TULANIP TEST SITE
3-13-75

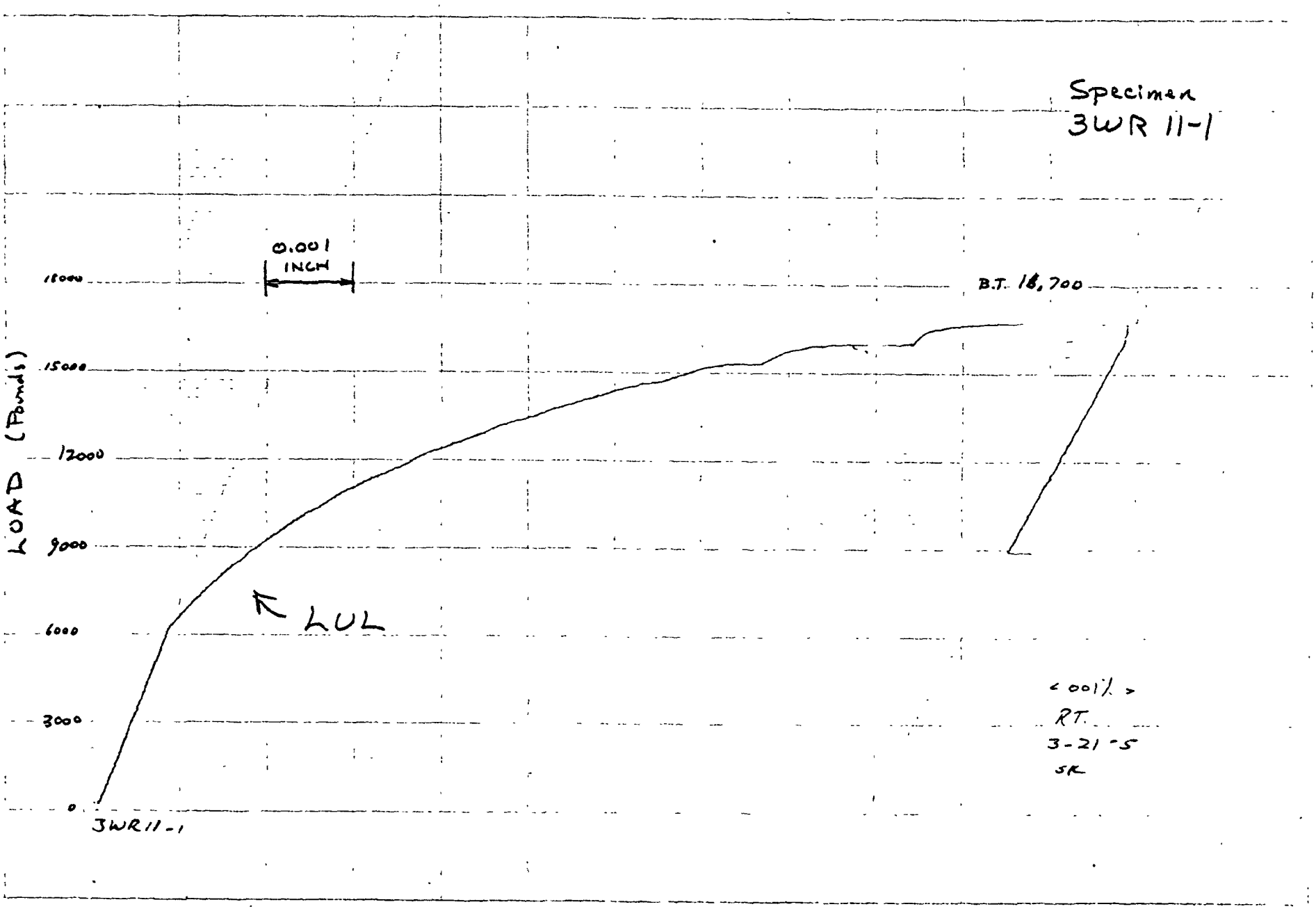

Specimen
2TH 31-2
0.002
INCH
278,500 LBS
280
240
200
160
120
80
40
LOAD (Kips)
LOAD ~ 40,000 LBS / IN.
CRACK DISPL ~ 0.002 IN / IN.
SPECIMEN 2DH 31-2 (-423°F)
TULALIP TEST SITE
4-21-75

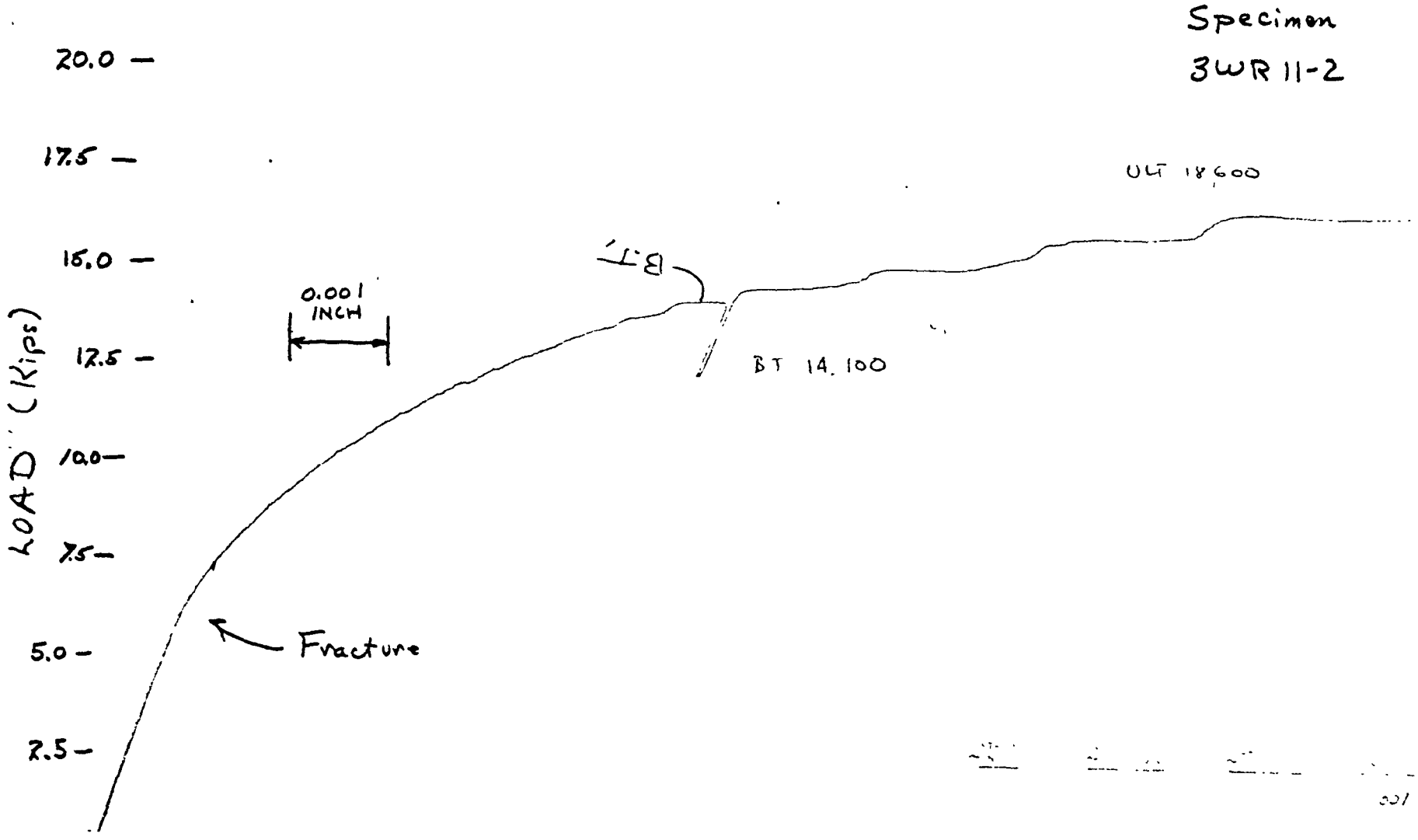

Specimen
3BH31-1
0.002
INCH
320
280
240
200
160
120
80
40
LOAD ~ 40,000 LBS/IN
LOAD (Kips)
eLUL
Cycle
1
10
20
40
60
80
90
25
CRACK DISPL ~ .002 IN/IN
SPECIMEN 3BH31-1
PROOF LOAD & CYCLE IN LH_2
TULALIP 8-18-75


Specimen
2WR 11-1
LOAD (KIPS)
18
15
12
9
6
3
0
ULT 18,300 LBS.
OL 19,350
LUL
Fracture
0.001 INCH
0.002 INCH
2WR11-1
<.001" >
<.002" >
3-10-5 SK
R.T.
<.001" >

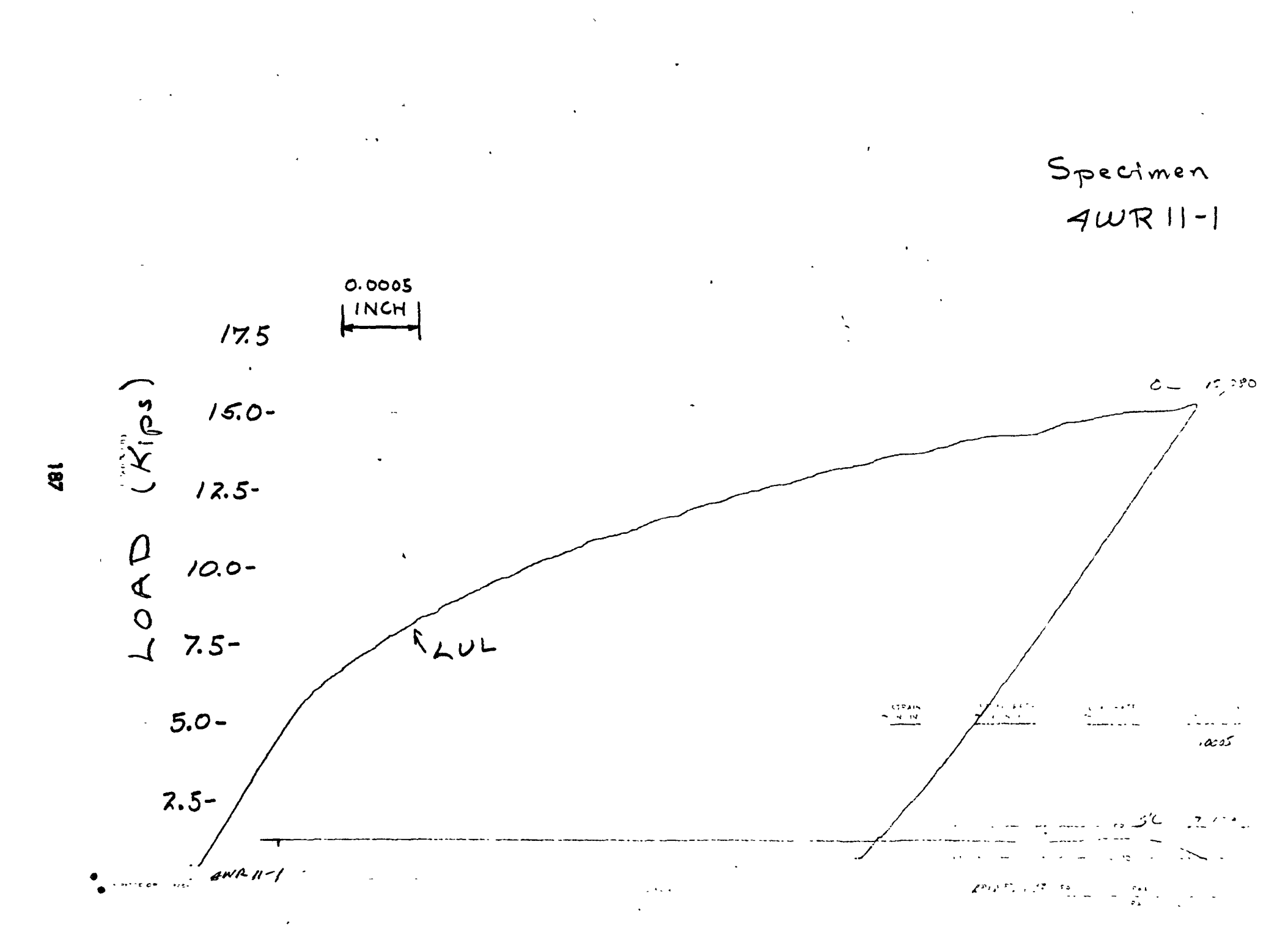

Specimen
2WR11-2
0.001
INCH
ULT 18,600 LBS.
B.J. 16,320
O.L. 13,250
← Fracture
← LUL
LOAD (Kips)
18
15
12
9
6
3
2WR11-2
<001>
3-10-5
R.T.

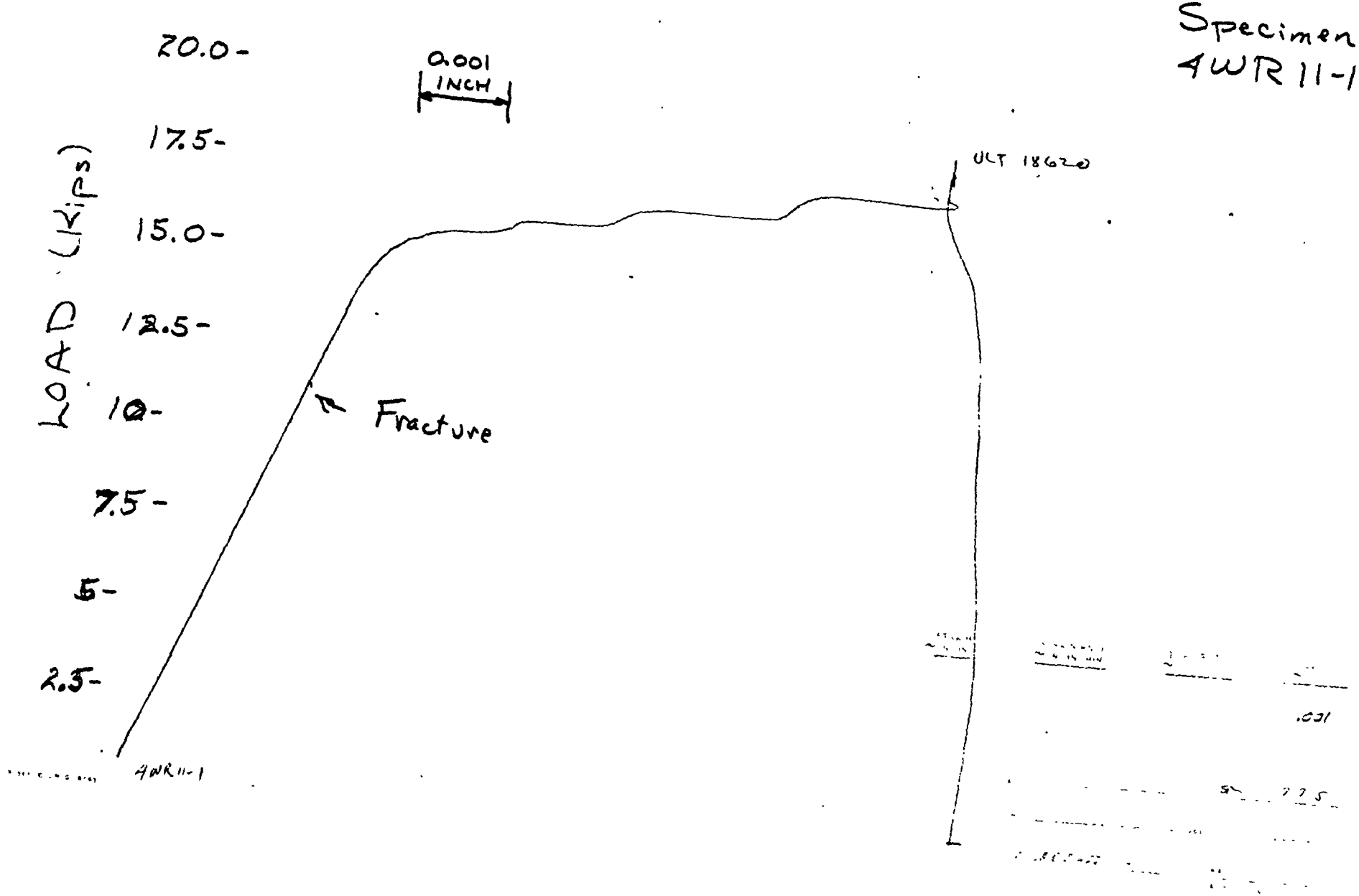

Specimen
2WR11-3
21
18
15
12
9
6
3
LOAD (KIPS)
0.001 INCH
ULT 18,150 LBS.
BR. 15,120 LBS.
P.O.F. 13,070 LBS.
11720
O.L.
LUL
LUL
Fracture
2WR11-3
<.001% -
R.T. 3-10-5
SK.

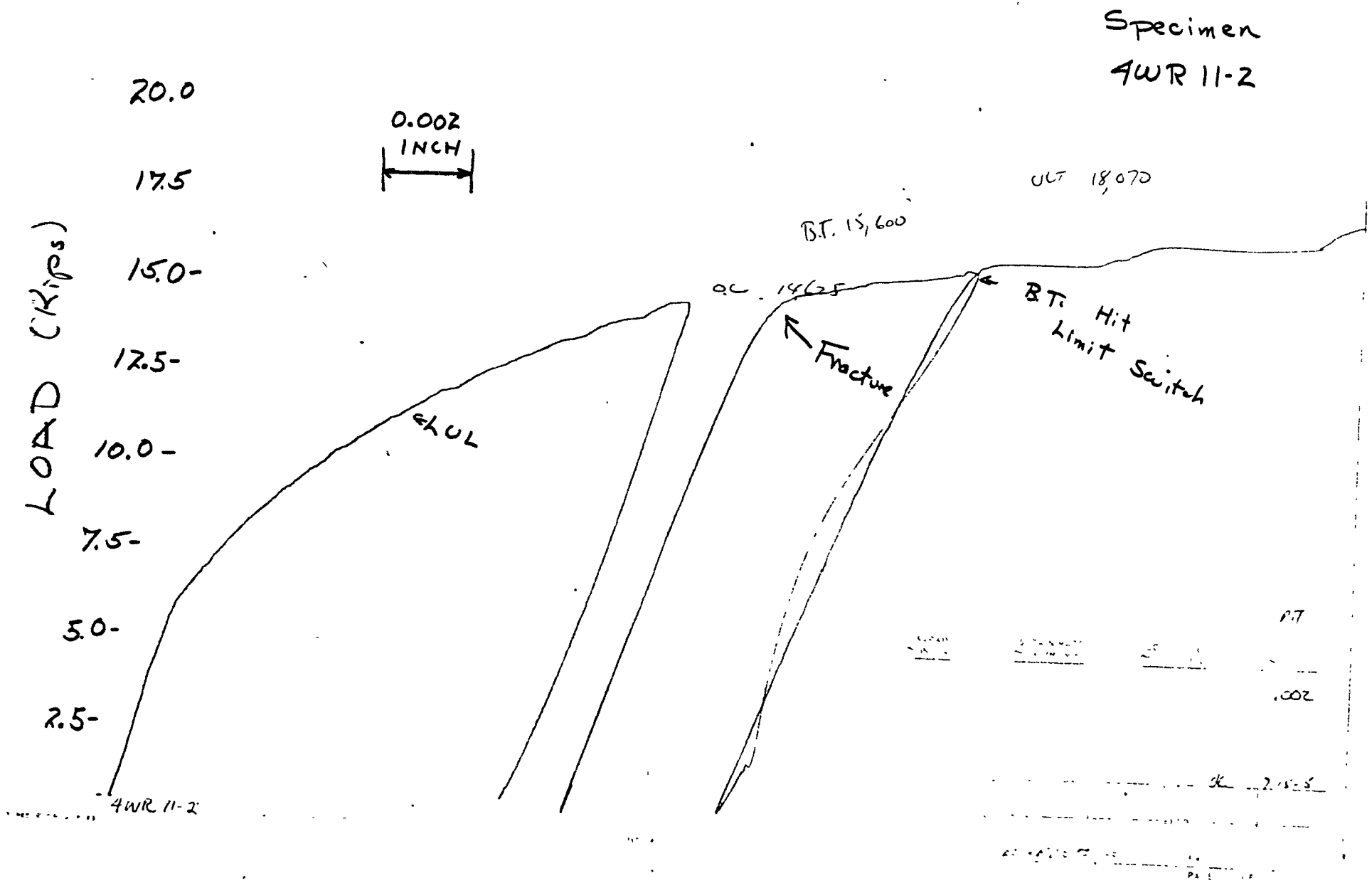

Specimen
3WR 11-1
0.001
INCH
B.T. 18,700
LOAD (Pounds)
18000
15000
12000
9000
6000
3000
0
LUL
3WR11-1
<.001"/>
RT.
3-21-5
SR

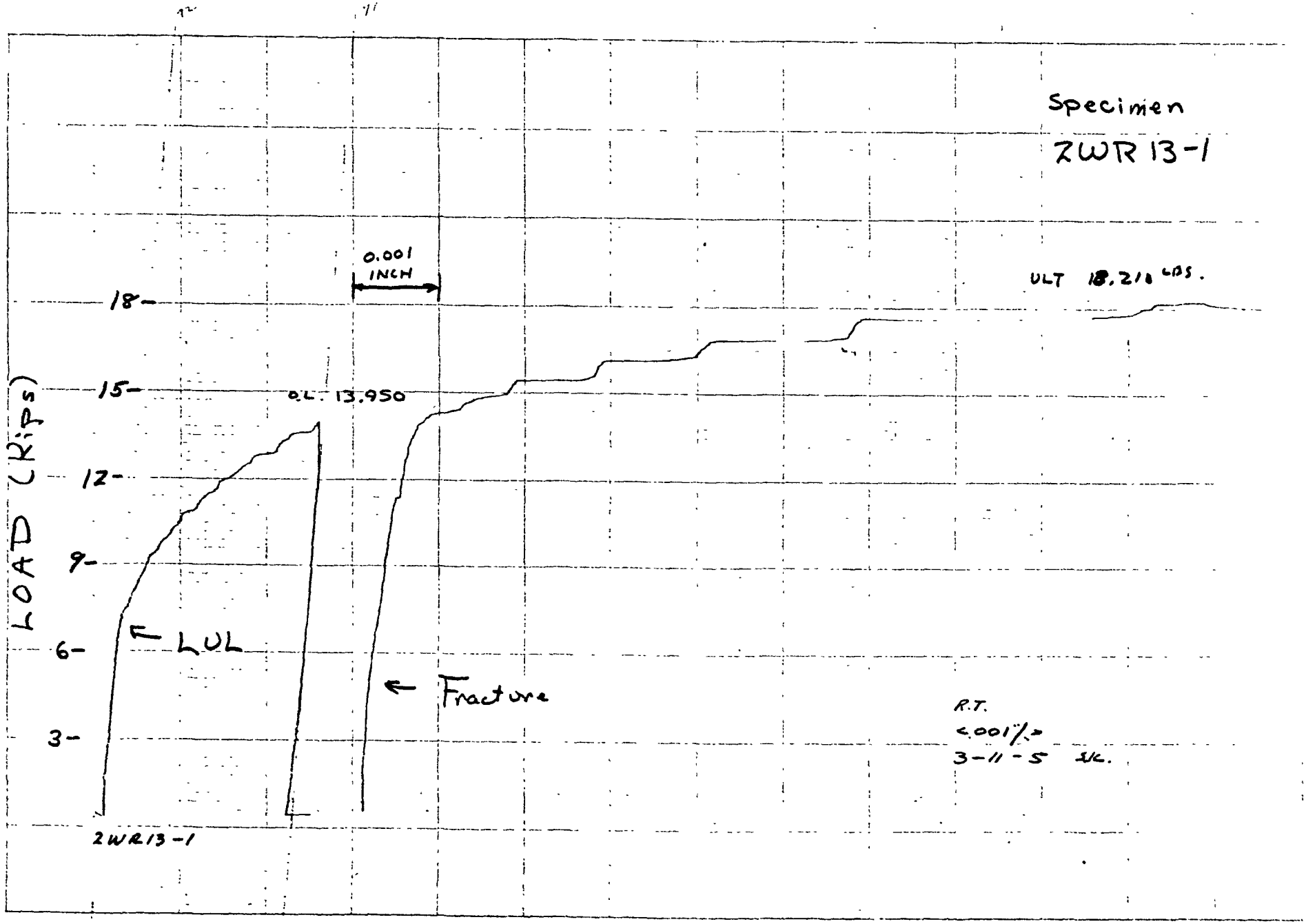

Specimen
3WR 11-2
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
LOAD (Kips)
0.001
INCH
BT
ULT 18,600
BT 14,100
Fracture
3WR 11-2

Specimen
4WR11-1

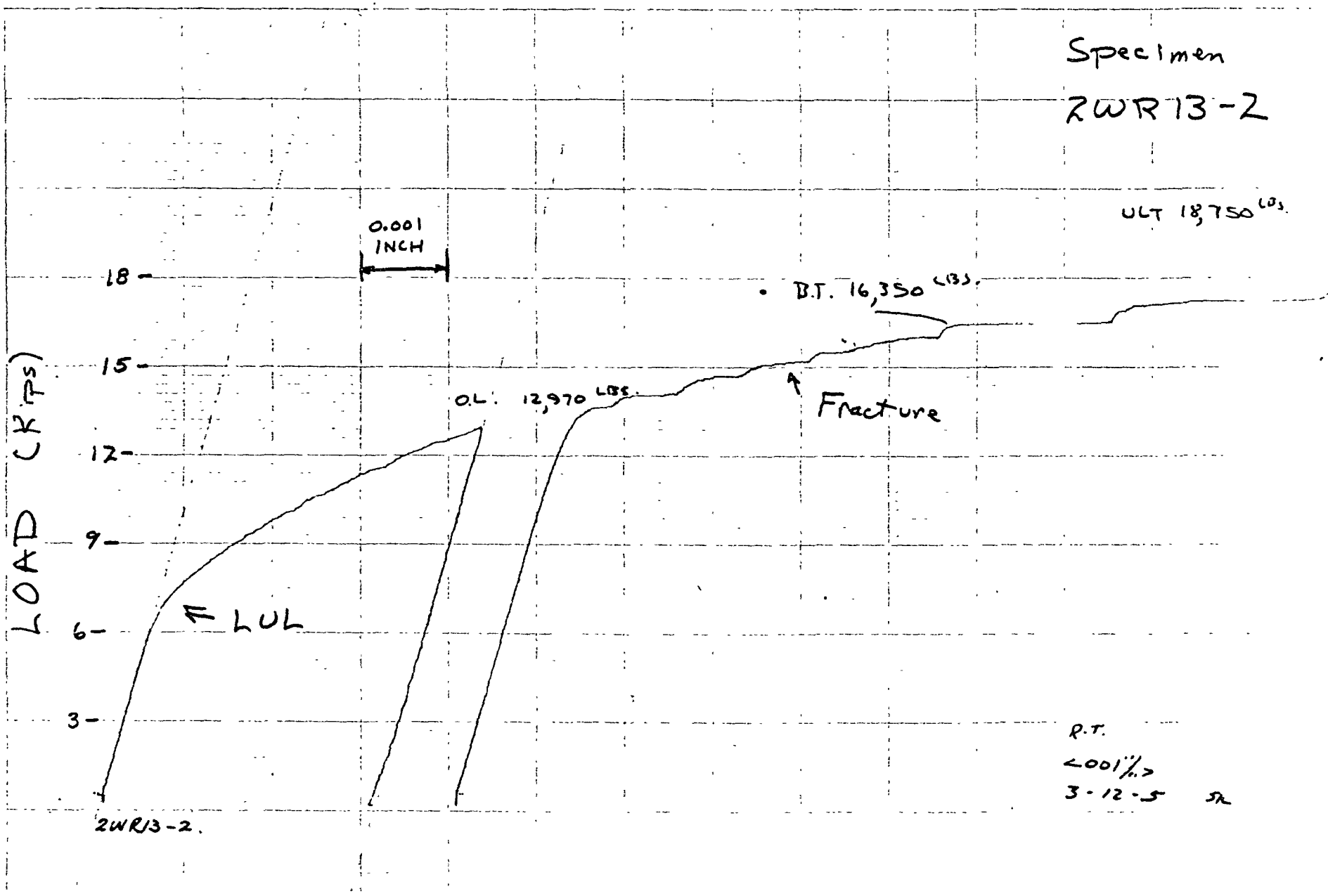


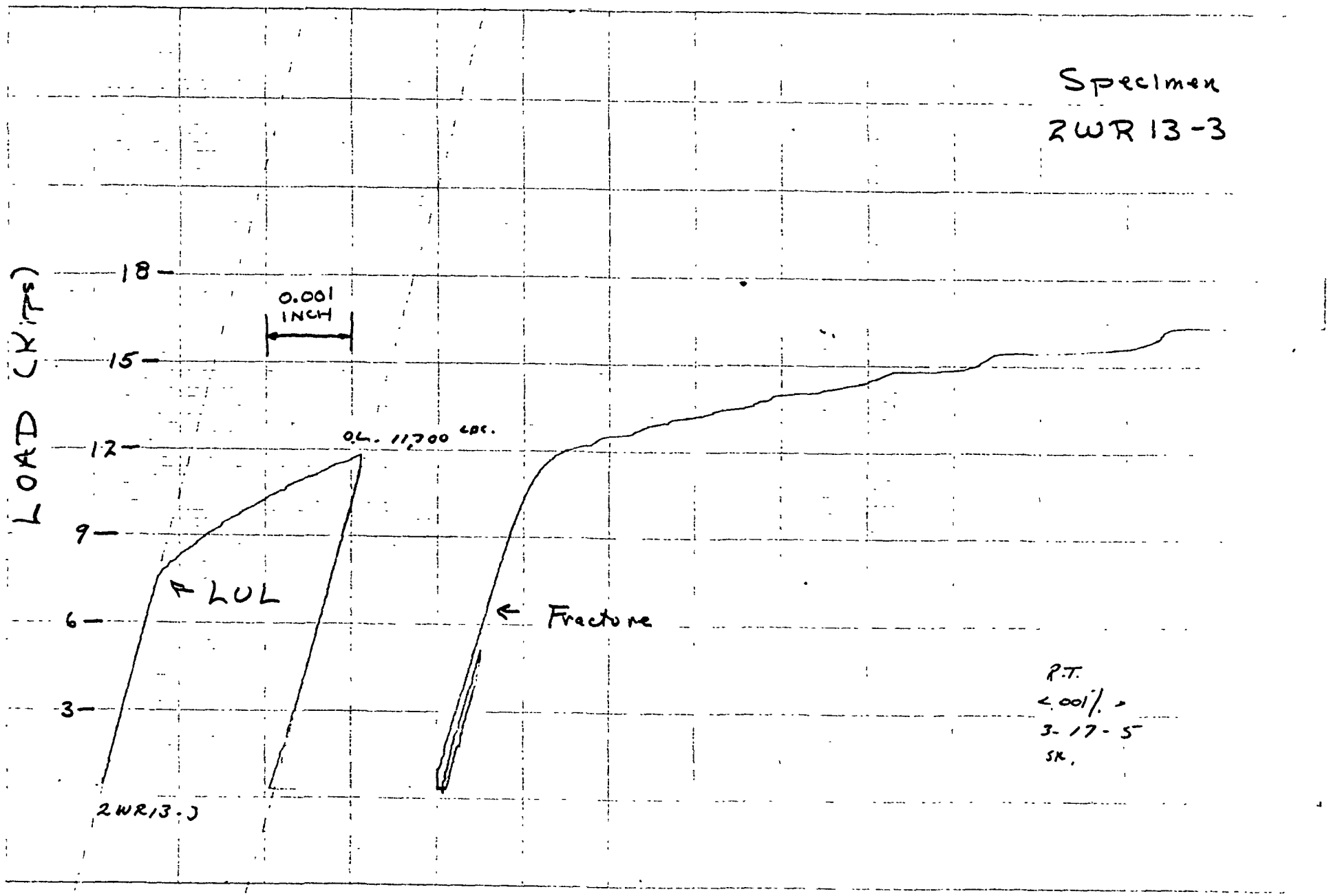

Specimen
4WR11-1
20.0
17.5
15.0
12.5
10
7.5
5
2.5
LOAD (KIPS)
0.001 INCH
ULT 18620
Fracture
4WR11-1

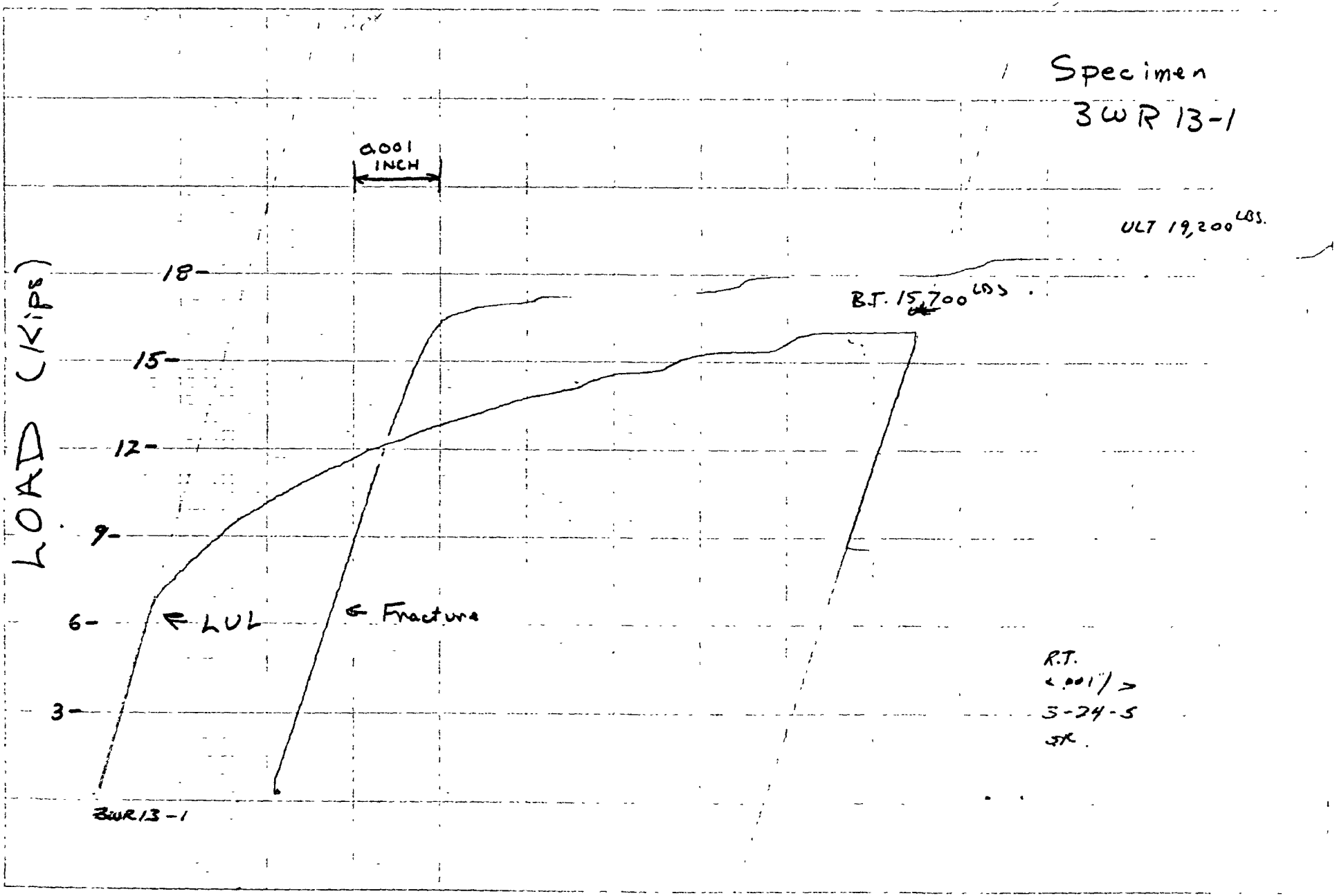

Specimen
4WR 11-2
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
LOAD (Kips)
0.002
INCH
ULT 18,070
B.T. 15,600
QC 14625
Fracture
BTi Hit
Limit Switch
ELUL
4WR 11-2
.002

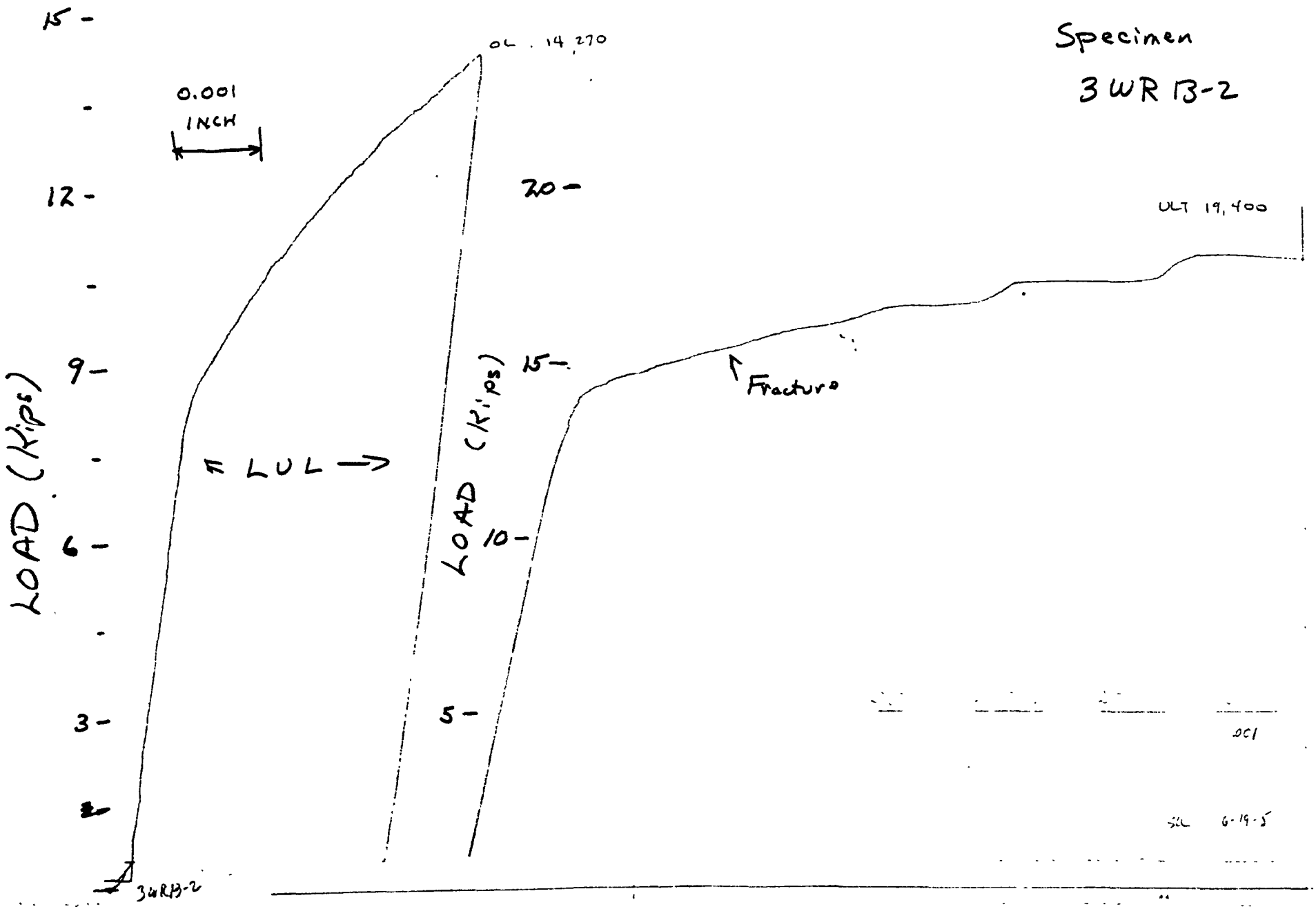

Specimen
2WR13-1
0.001 INCH
ULT 18,210 LBS.
O.L. 13,950
LOAD (KIPS)
18
15
12
9
6
3
LUL
Fracture
R.T.
<.001"/>
3-11-5 SK.
2WR13-1

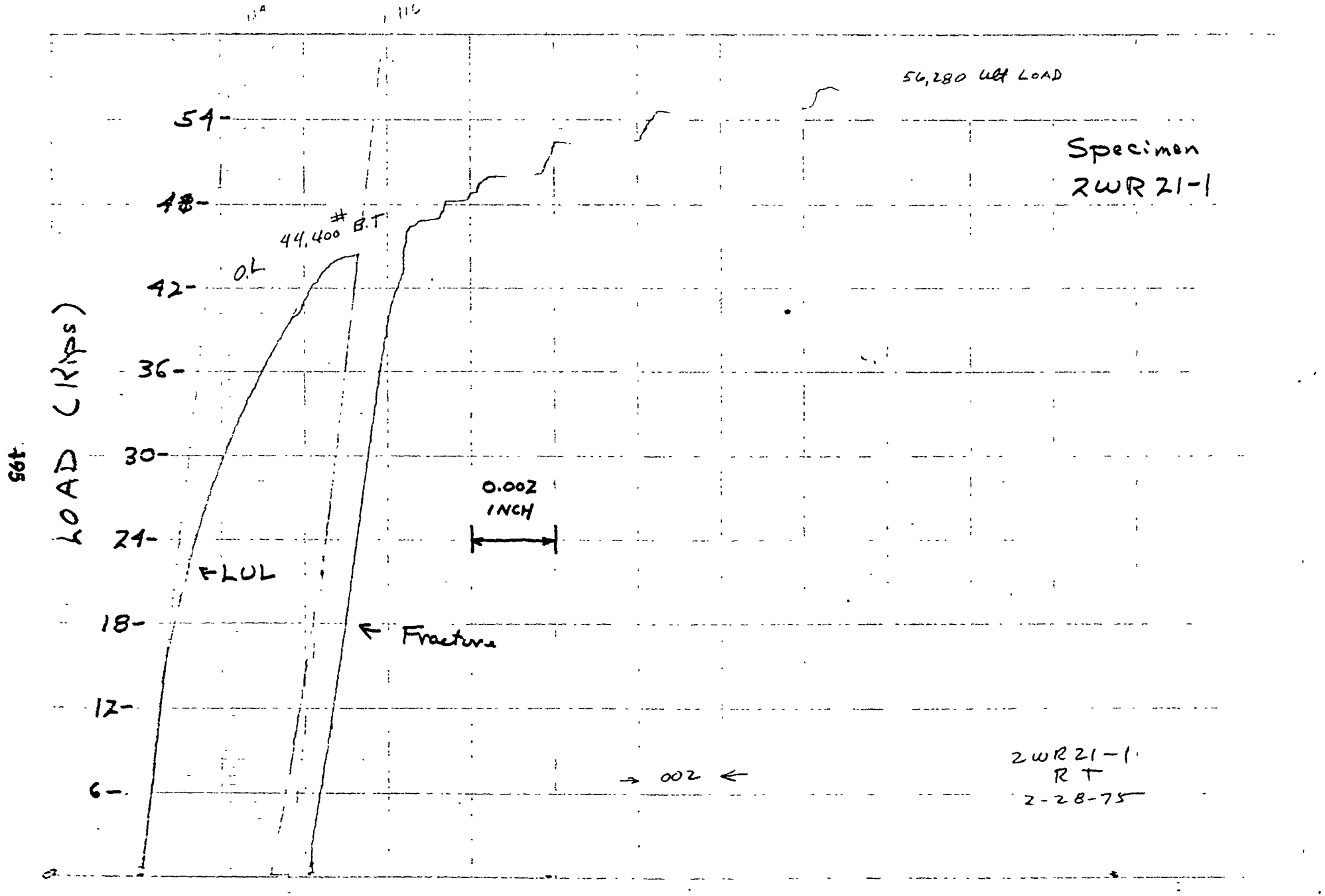
061

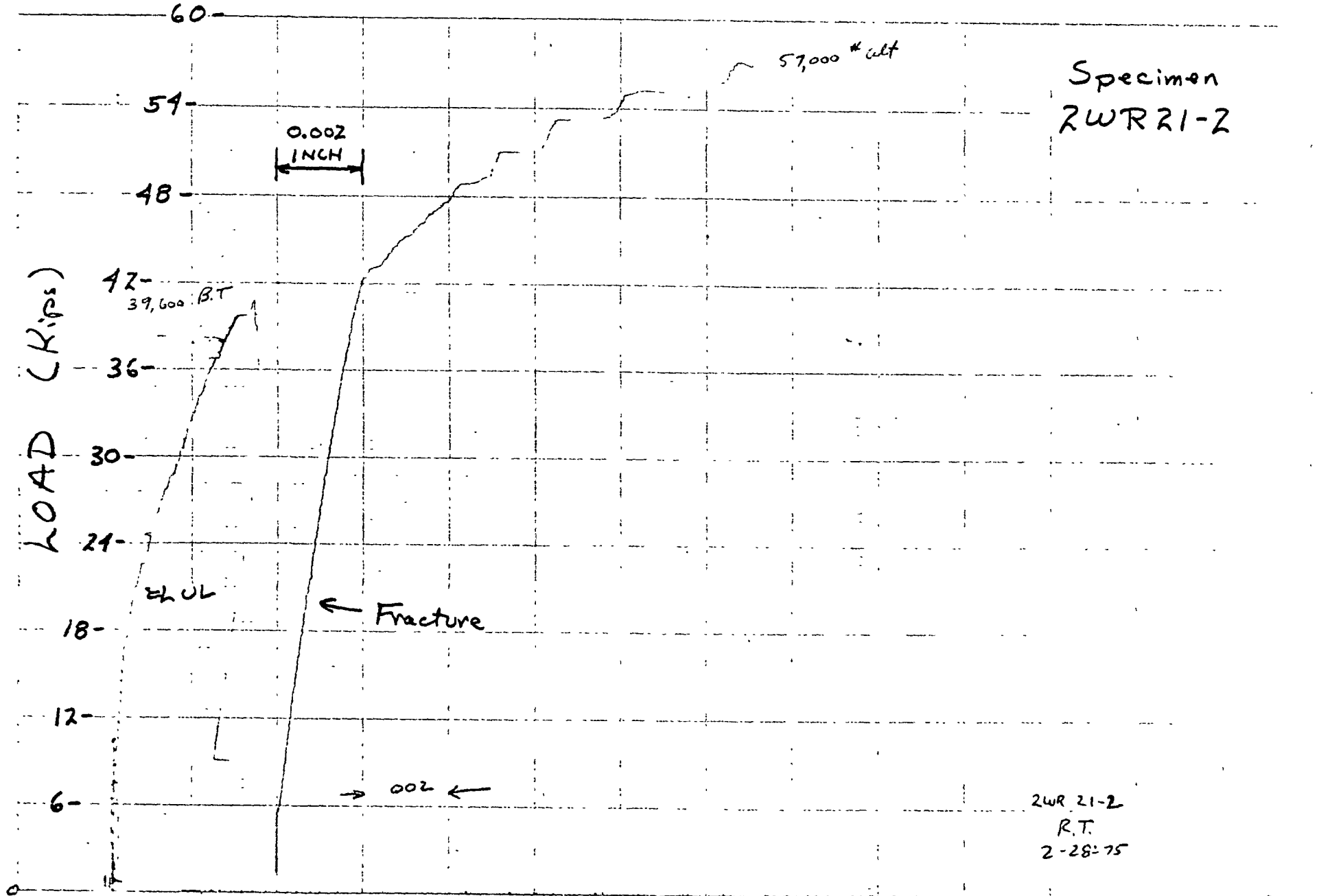

Specimen
2WR13-2
ULT 18,750 LBS.
0.001 INCH
18
15
12
9
6
3
LOAD (KIPS)
B.T. 16,350 LBS.
O.L. 12,970 LBS.
Fracture
LUL
2WR13-2.
R.T.
<.001"/in.>
3-12-5 SR

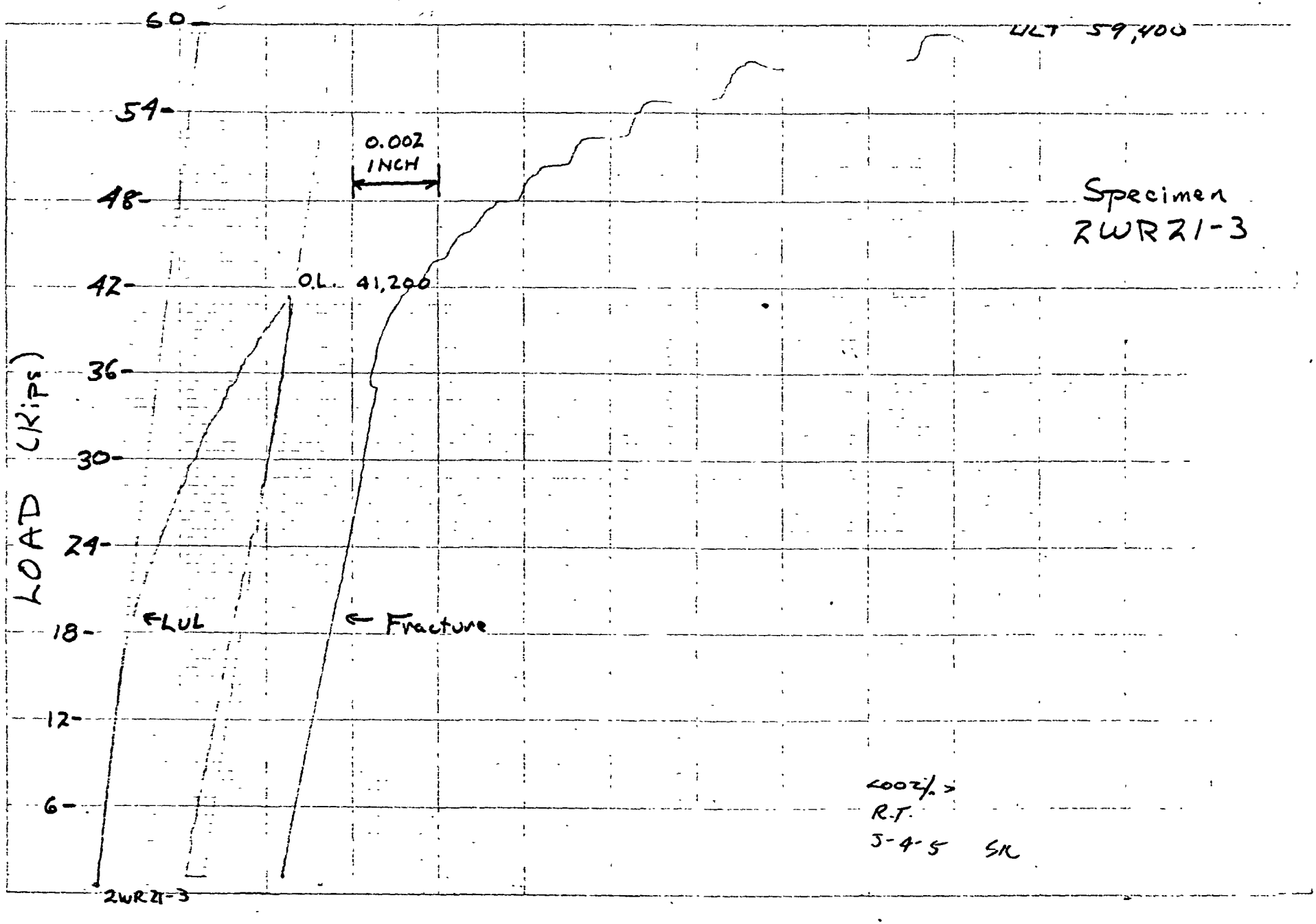

Specimen
2WR13-3
LOAD (Kips)
18
15
12
9
6
3
0.001 INCH
O.L. 11,700 lbs.
← LOL
← Fracture
P.T.
<.001"/hr
3-17-5
SR.
2WR13.J


Specimen
3WR 13-1
.001 INCH
ULT 19,200 LBS.
B.T. 15,700 LBS.
LOAD (KIPS)
18
15
12
9
6
3
← LUL
← Fracture
R.T.
<.001"/>
5-24-5
3WR13-1

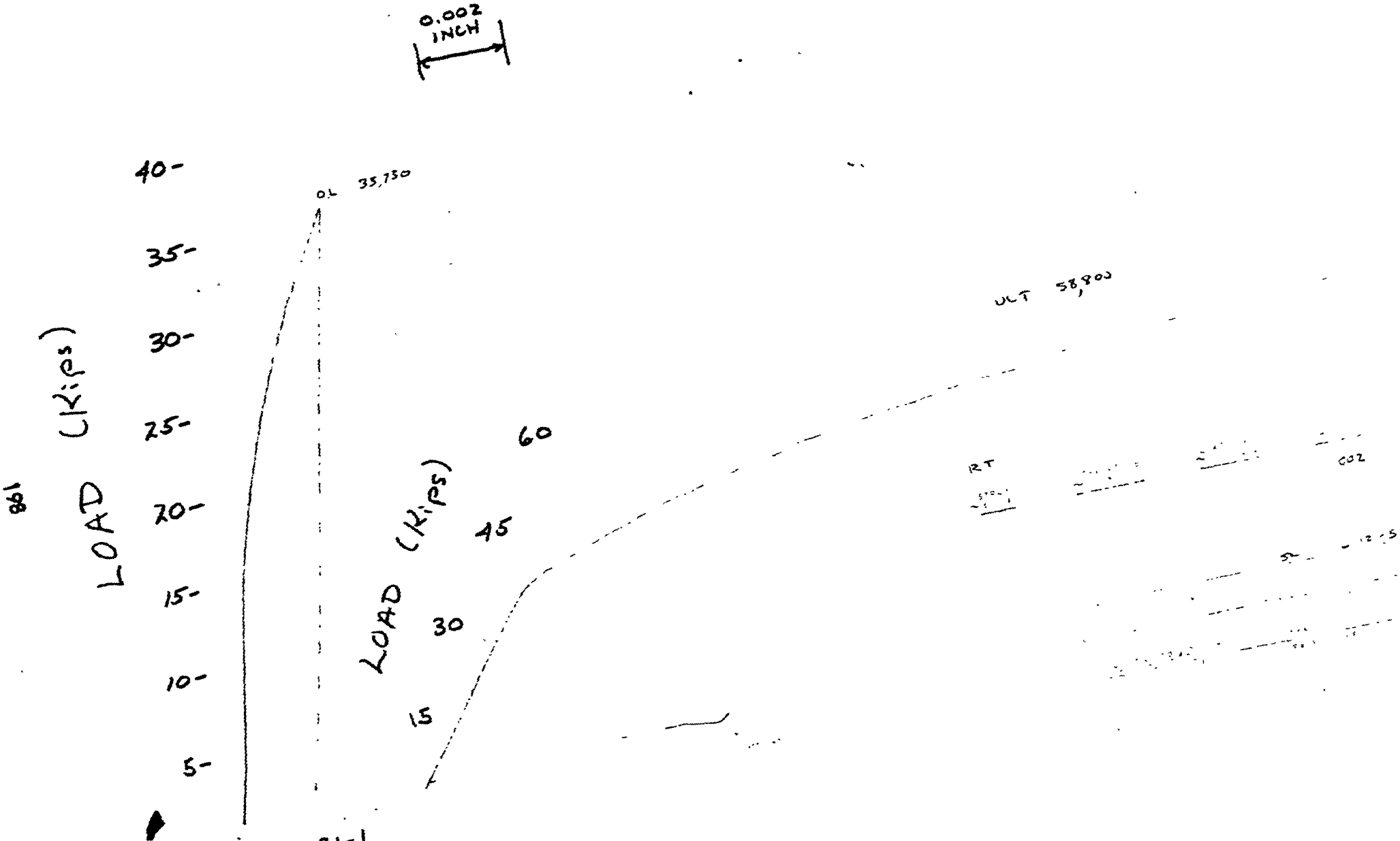

Specimen
3WR13-2
0.001
INCH
OL . 14,270
ULT 19,400
Fracture
LOAD (Kips)
LOAD (Kips)
15
12
9
6
3
20
15
10
5
3WR13-2


56,280 ULT LOAD
Specimen
2WR21-1
54
48
42
36
30
24
18
12
6
44,400 # B.T
O.L
FLUL
LOAD (Kips)
0.002
INCH
← Fracture
→ 002 ←
2WR21-1
RT
2-28-75

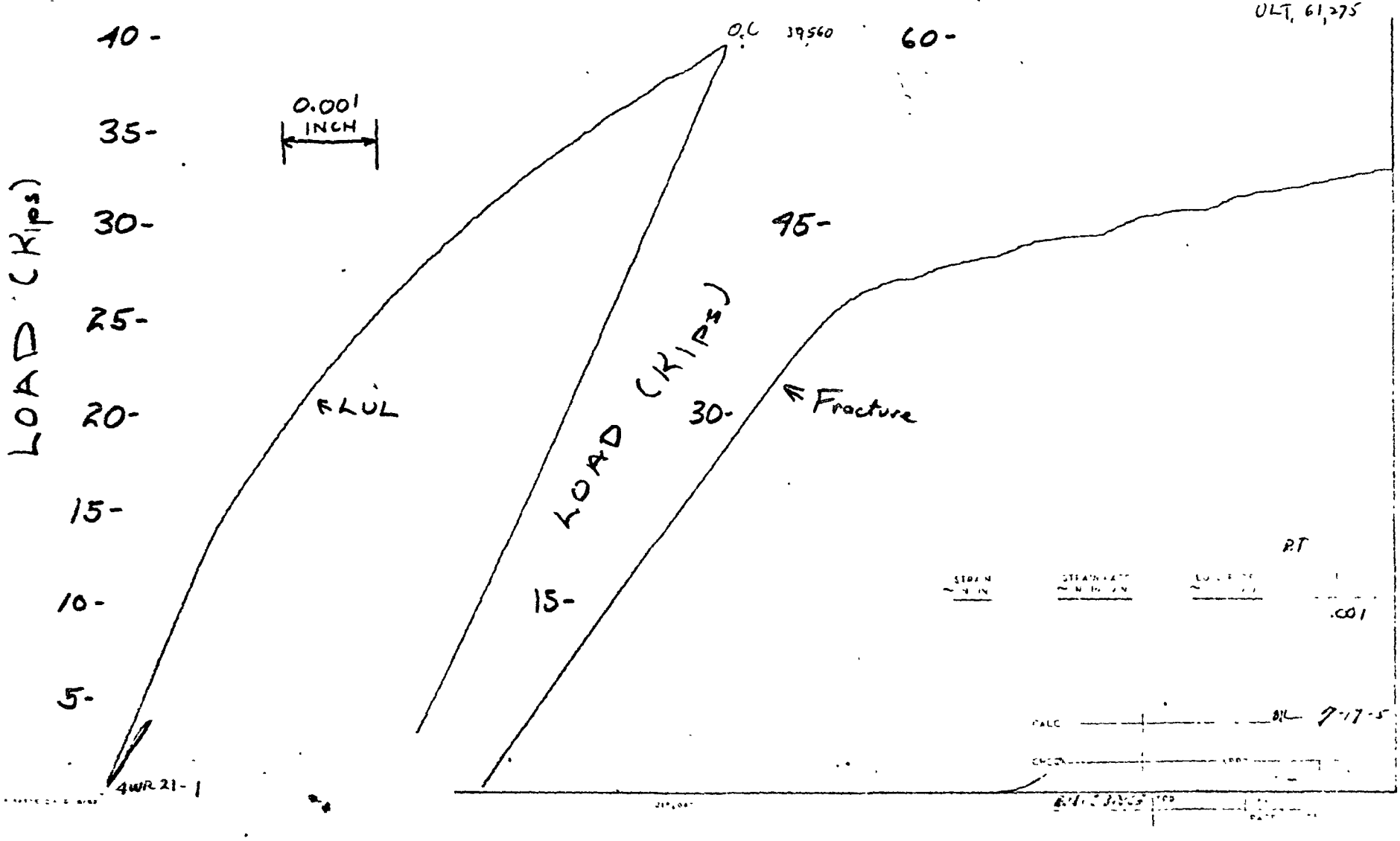

60
54
48
42
36
30
24
18
12
6
0
LOAD (Kips)
0.002 INCH
57,000 # ult
Specimen 2WR21-2
39,600 B.T
Pop In
Fracture
.002
2WR 21-2
R.T.
2-28-75

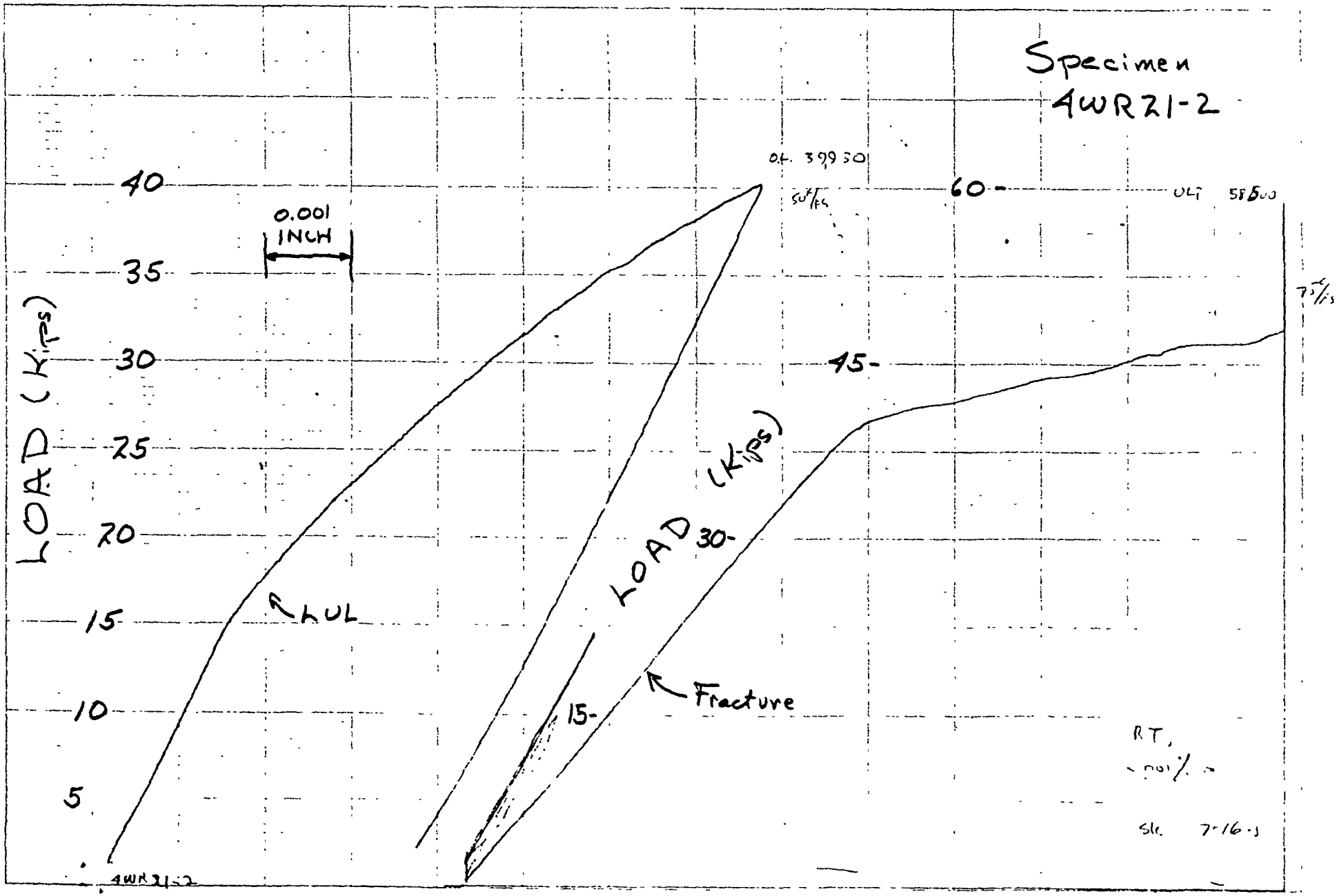

60
54
48
42
36
30
24
18
12
6
LOAD (KIPS)
ULT 59,400
0.002 INCH
Specimen 2WR21-3
O.L. 41,200
←FLUL
← Fracture
<.002/.>
R.T.
J-4-5 SR
2WR21-3

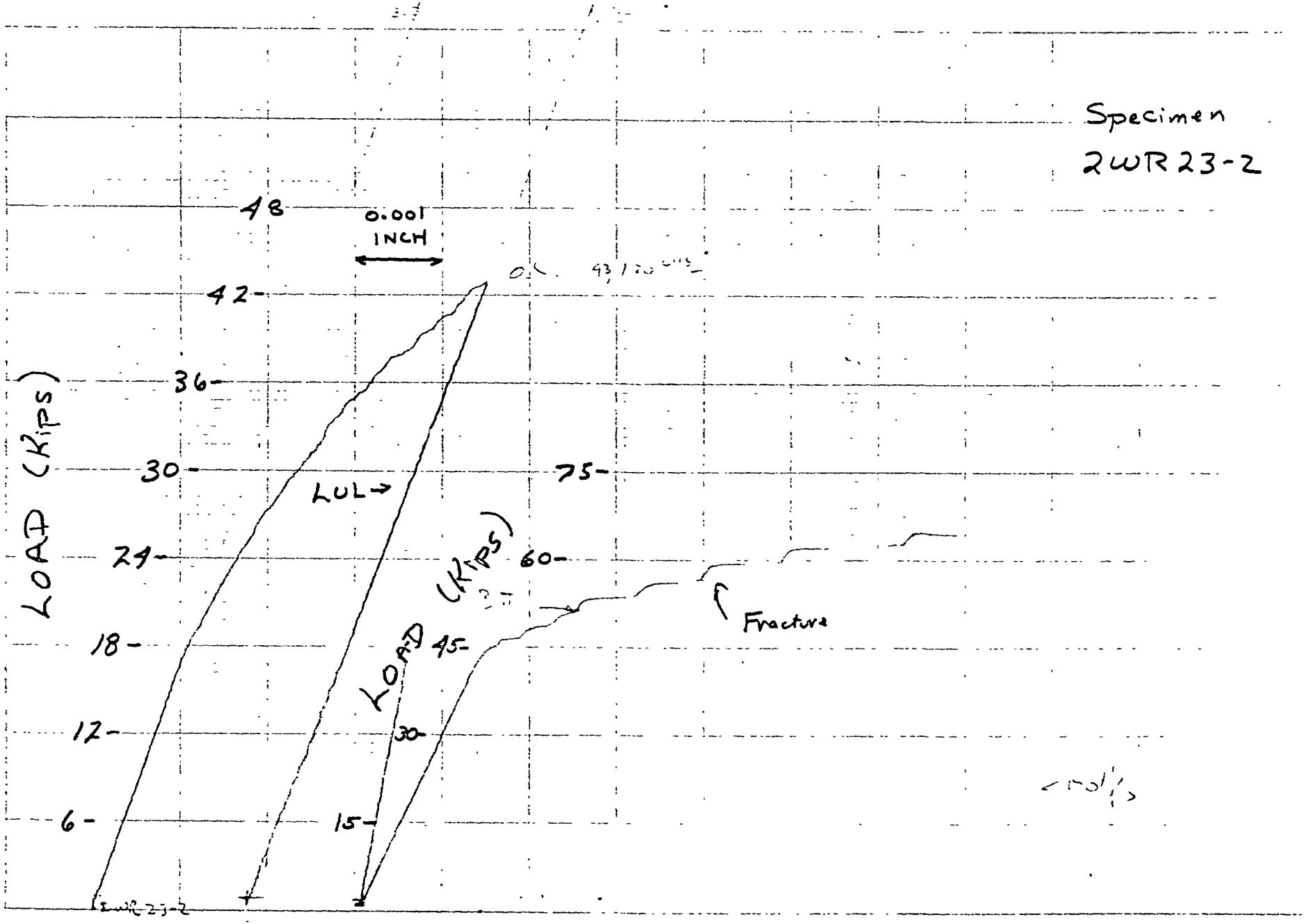
Specimen
3WR21-1

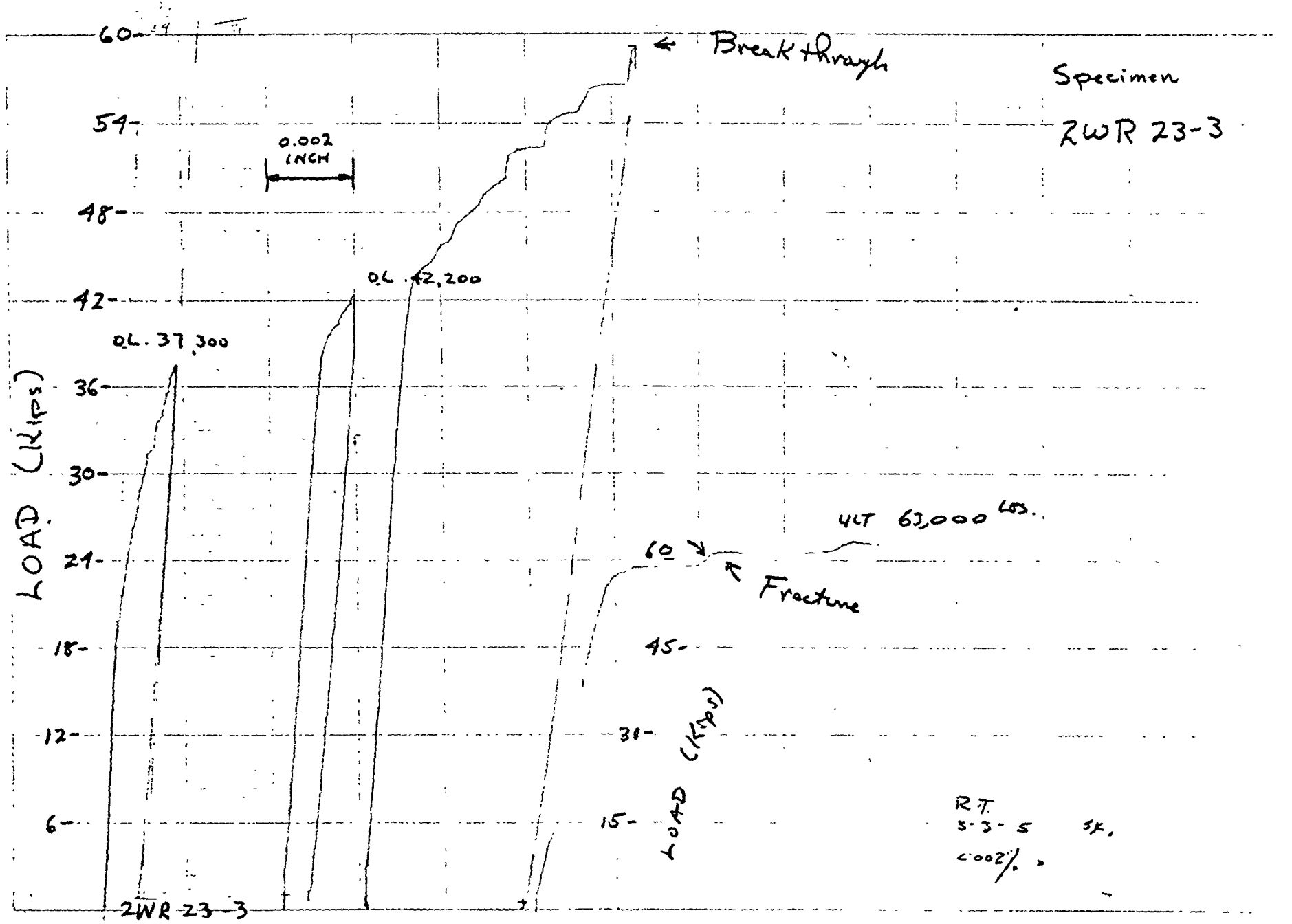


Specimen
4WR21-1

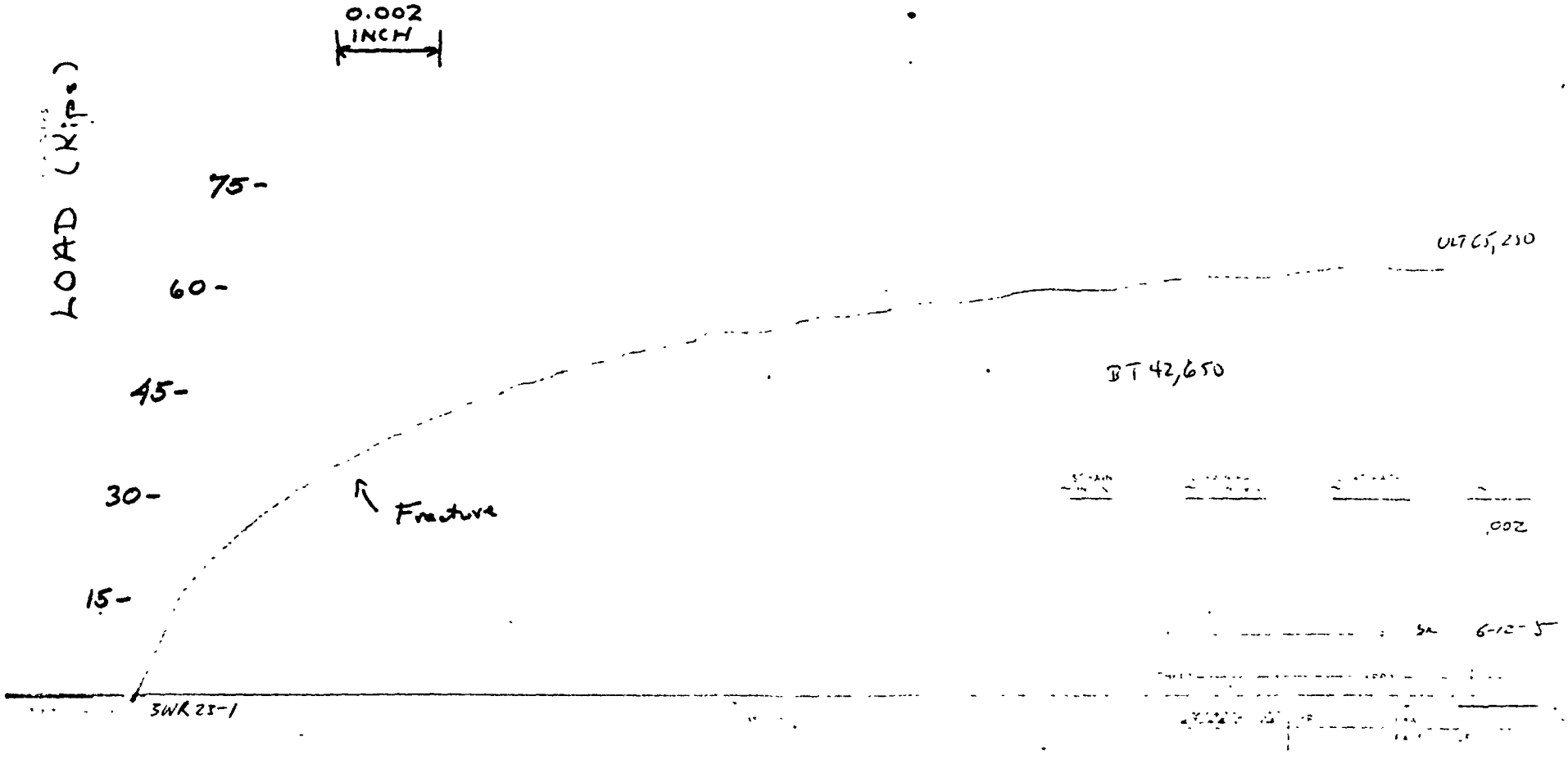


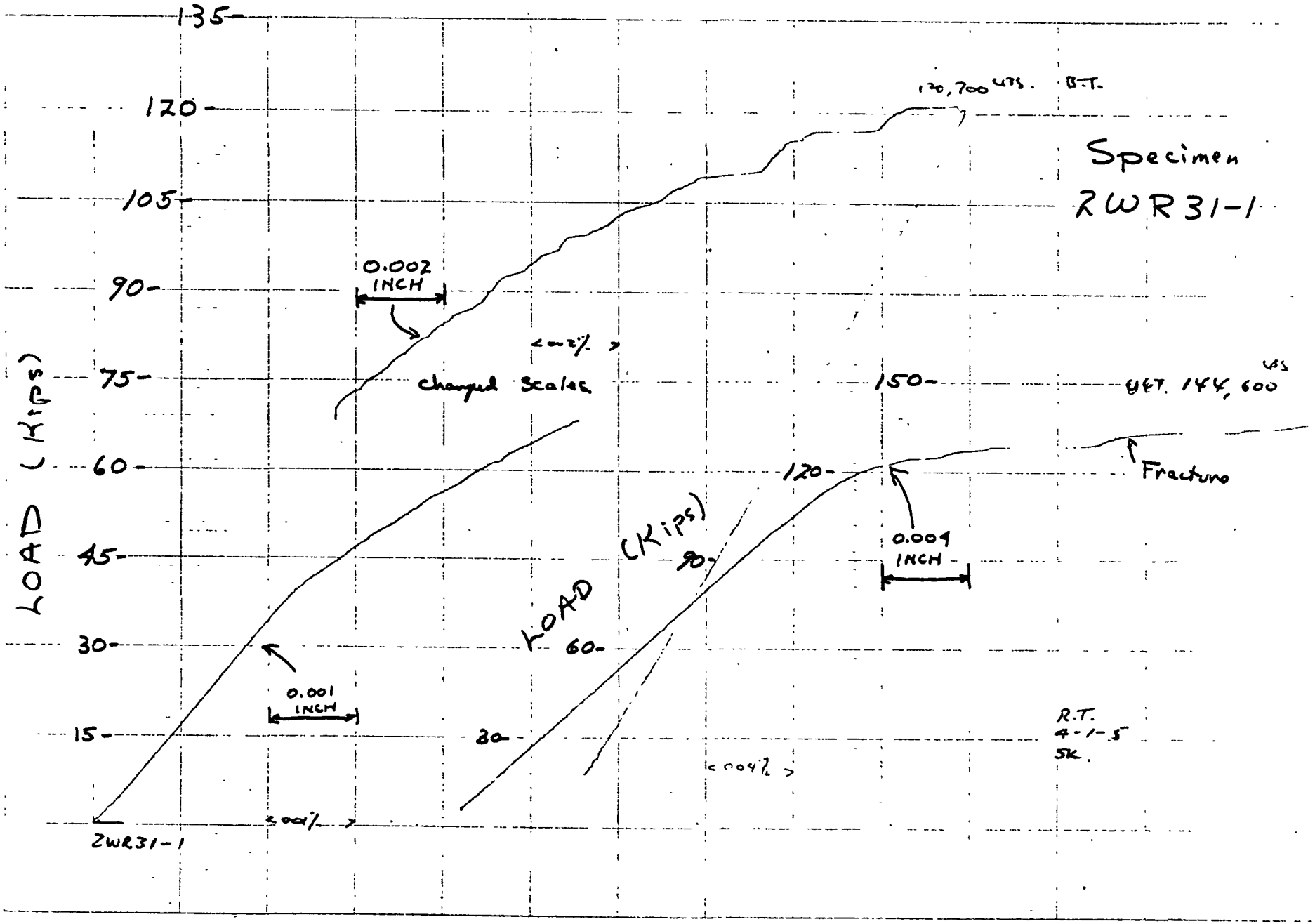

Specimen
4WR21-2
0.001
INCH
LOAD (K-IPS)
40
35
30
25
20
15
10
5
PUL
4WR21-2
60
45
30
15
LOAD (K-IPS)
Fracture
RT,

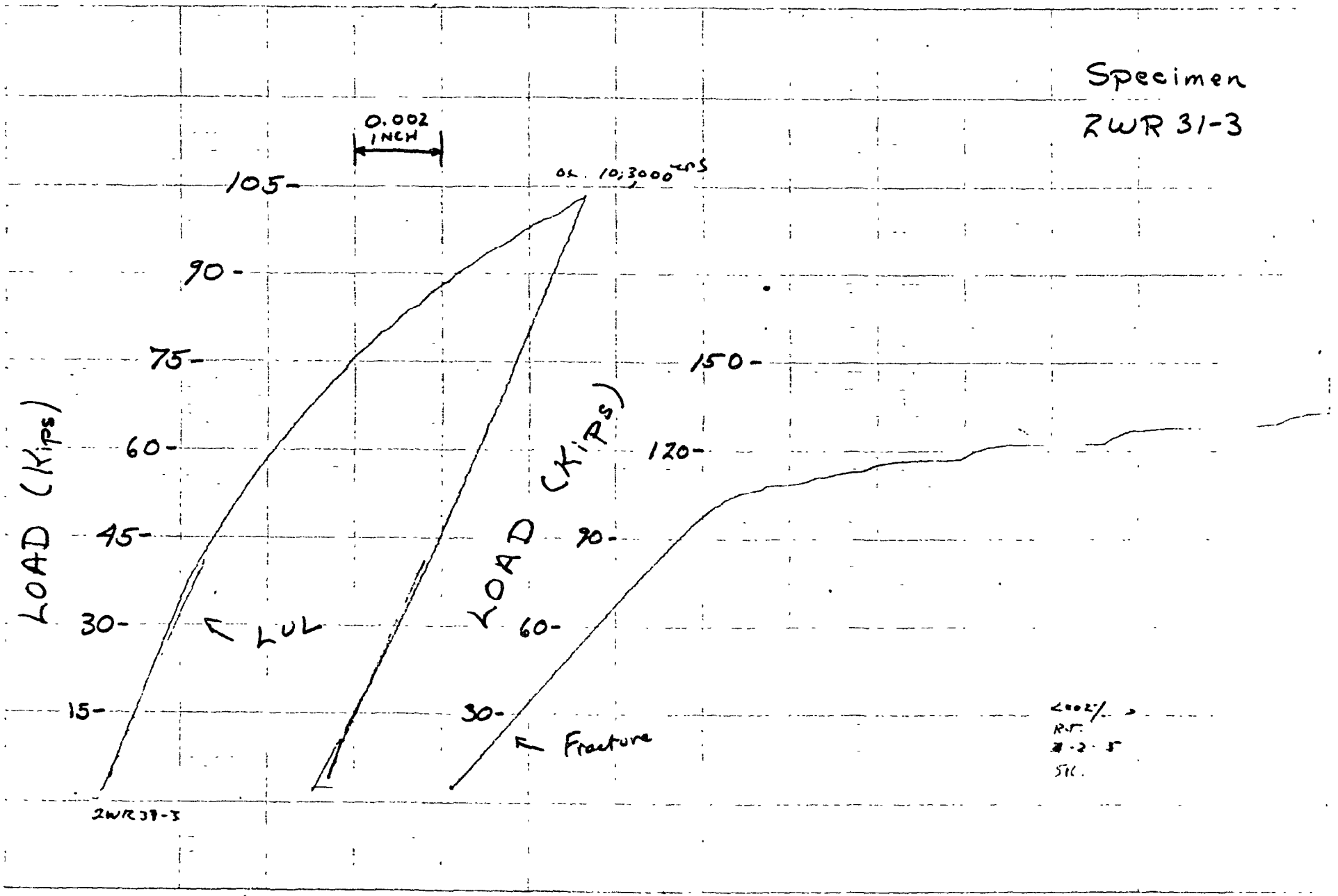

Specimen
2WR23-2
0.001
INCH
LOAD (KIPS)
LOAD (KIPS)
LUL
Fracture
48
42
36
30
24
18
12
6
75
60
45
30
15

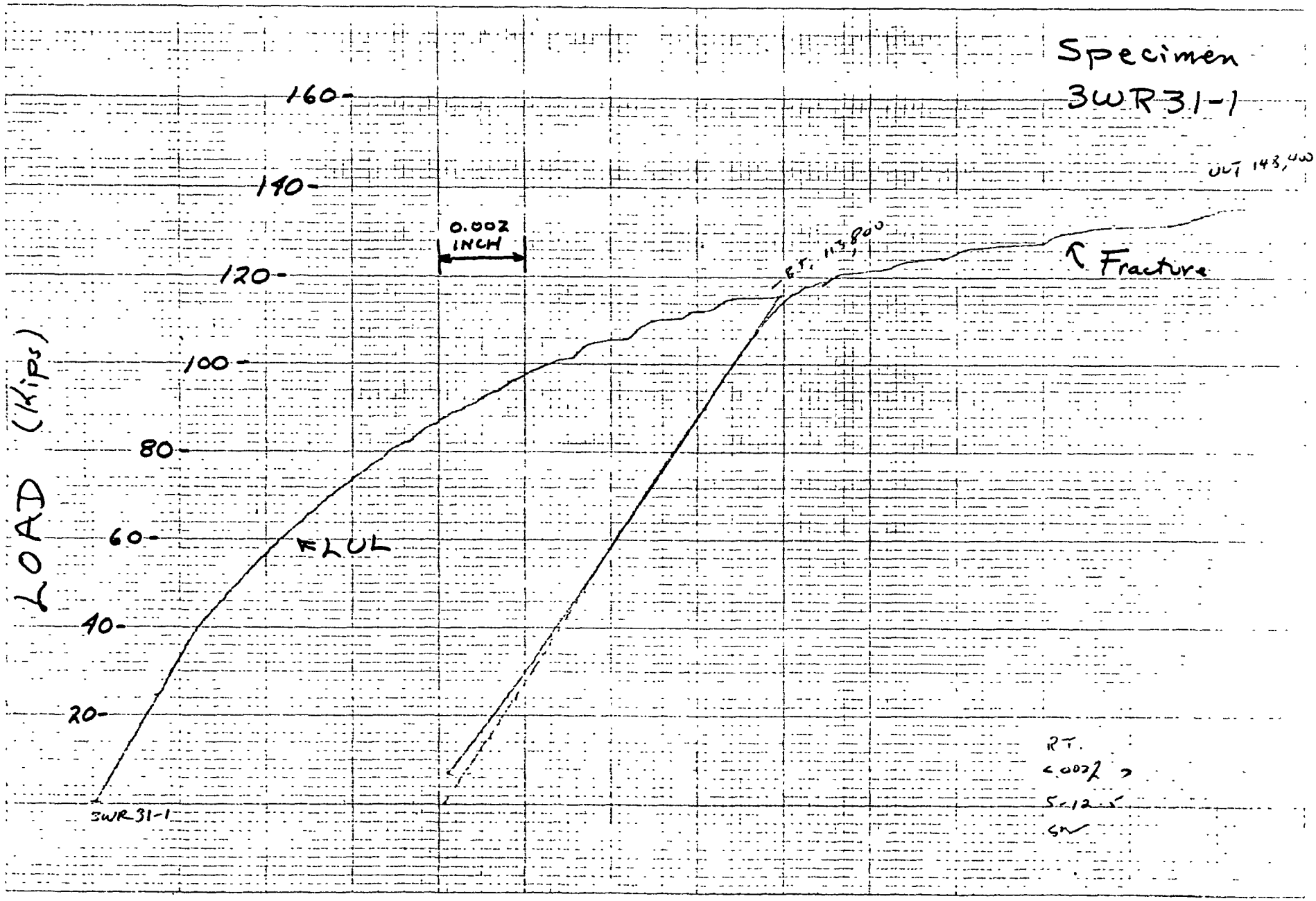

Break through
Specimen
RWR 23-3
0.002 INCH
OL. 42,200
OL. 37,300
60
54
48
42
36
30
21
18
12
6
LOAD (Kips)
UT 63,000 lbs.
Fracture
45
31
15
LOAD (Kips)
RT
5-3-5 5K,
.002"/.
RWR 23-3

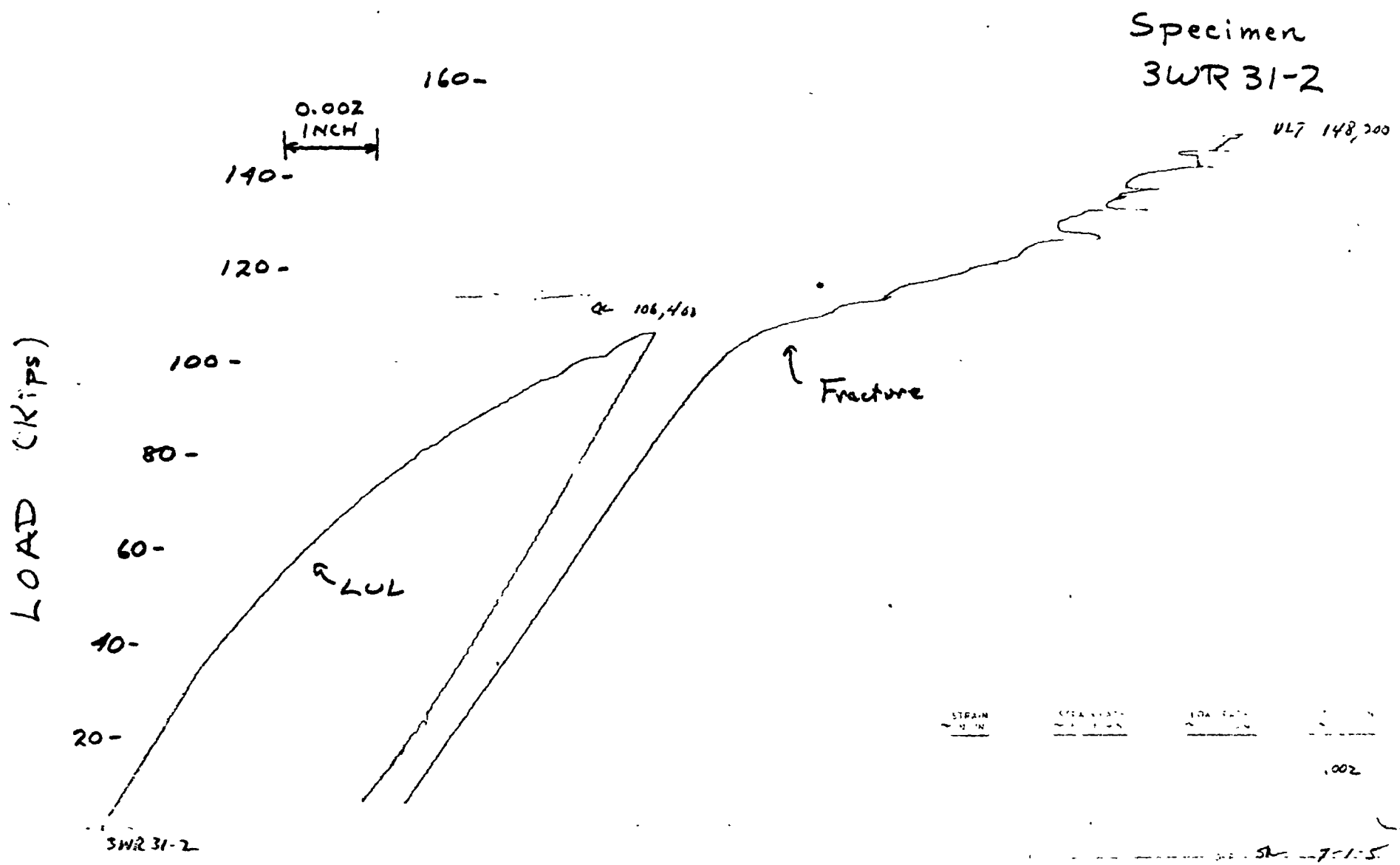
Specimen
3WR23-1

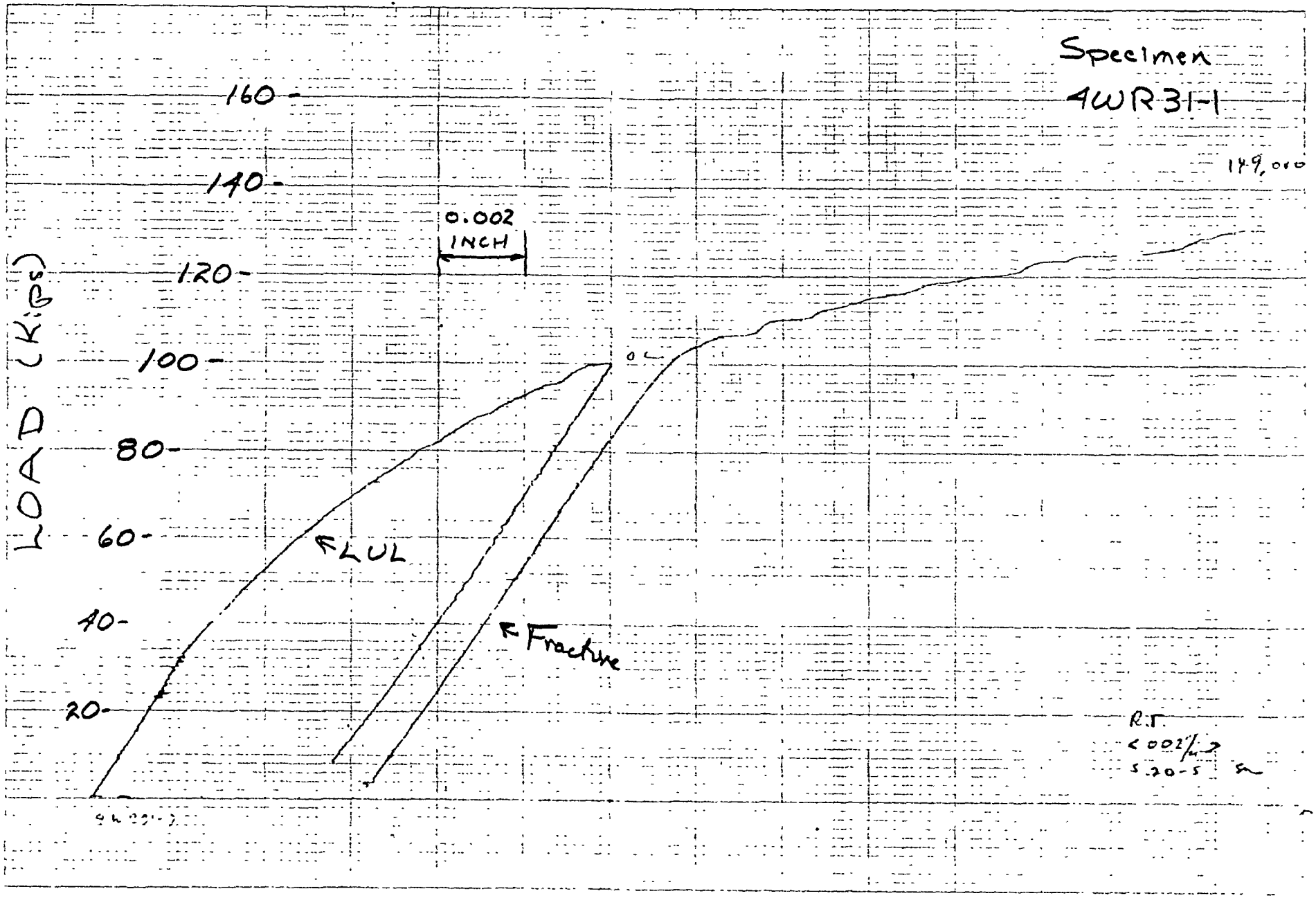


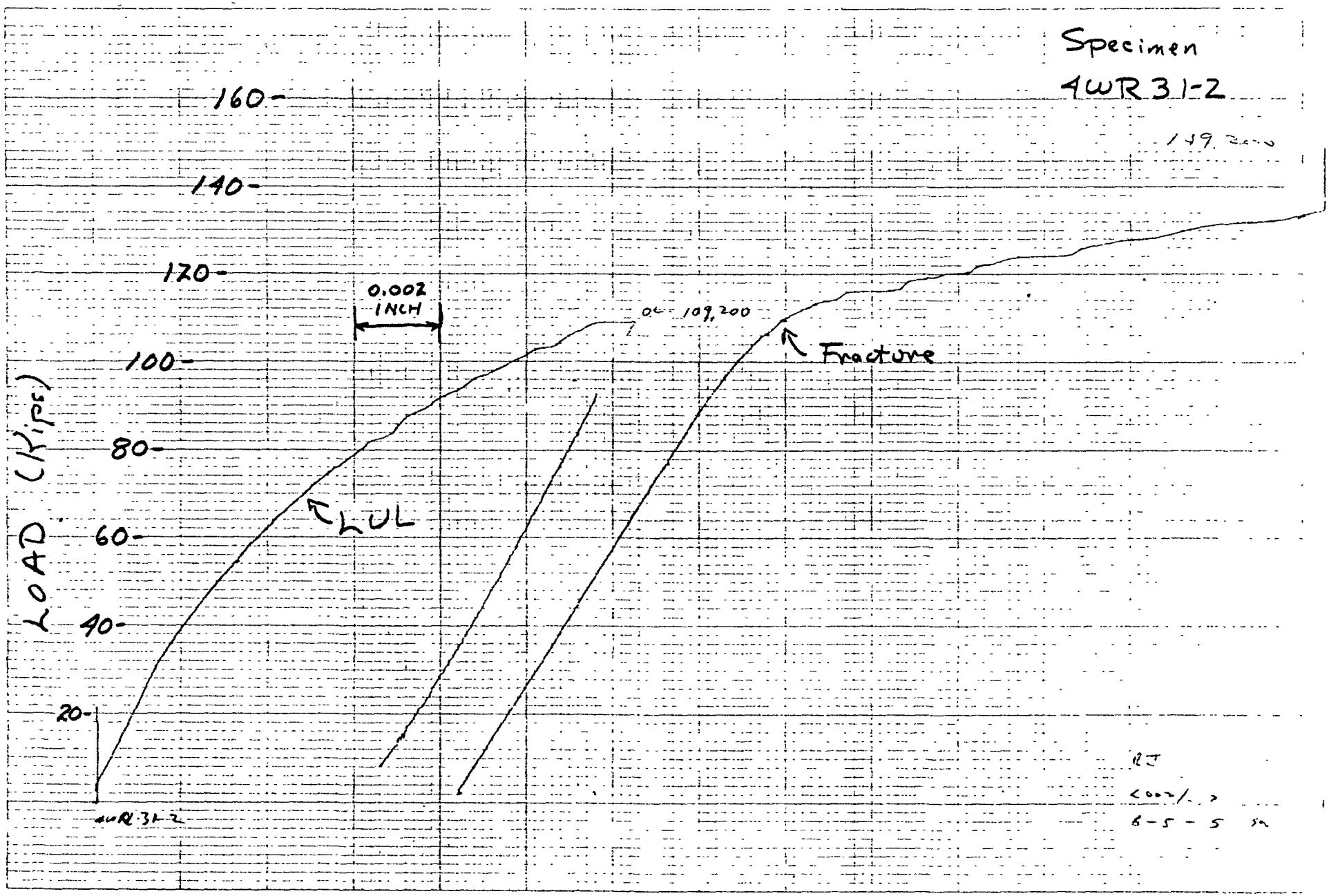

135
120
105
90
75
60
45
30
15
LOAD (KIPS)
120,700 LBS. B.T.
Specimen
RWR31-1
0.002
INCH
<--2%-->
changed Scales
150
UET. 144,600 LBS
Fracture
120
0.004
INCH
LOAD (KIPS)
90
60
30
0.001
INCH
R.T.
4-1-5
SK.
<.004%>
<.001%>
RWR31-1

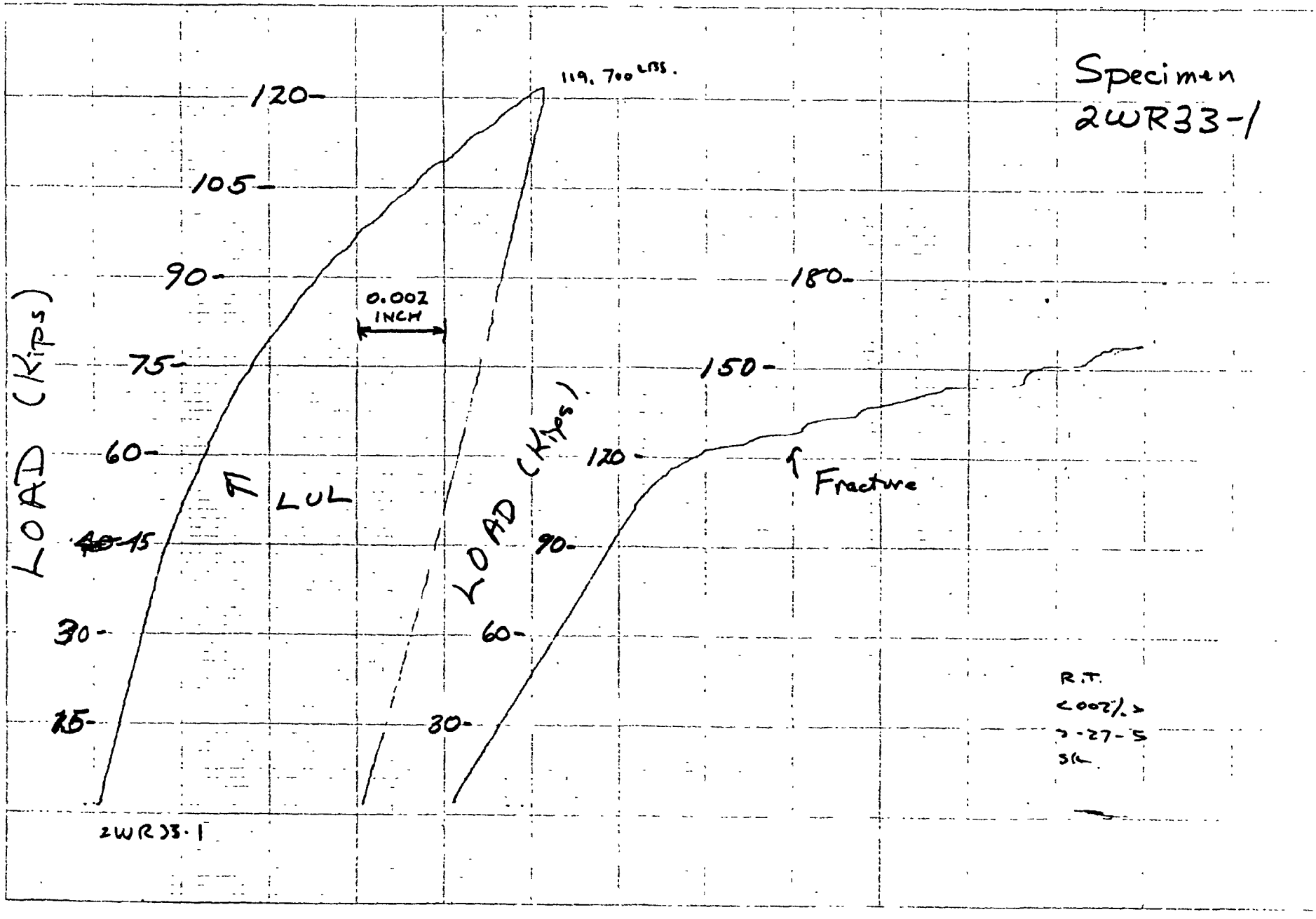

Specimen
2WR 31-3
0.002 INCH
105
90
75
60
45
30
15
LOAD (Kips)
LUL
2WR 31-3
150
120
90
60
30
LOAD (Kips)
Fracture

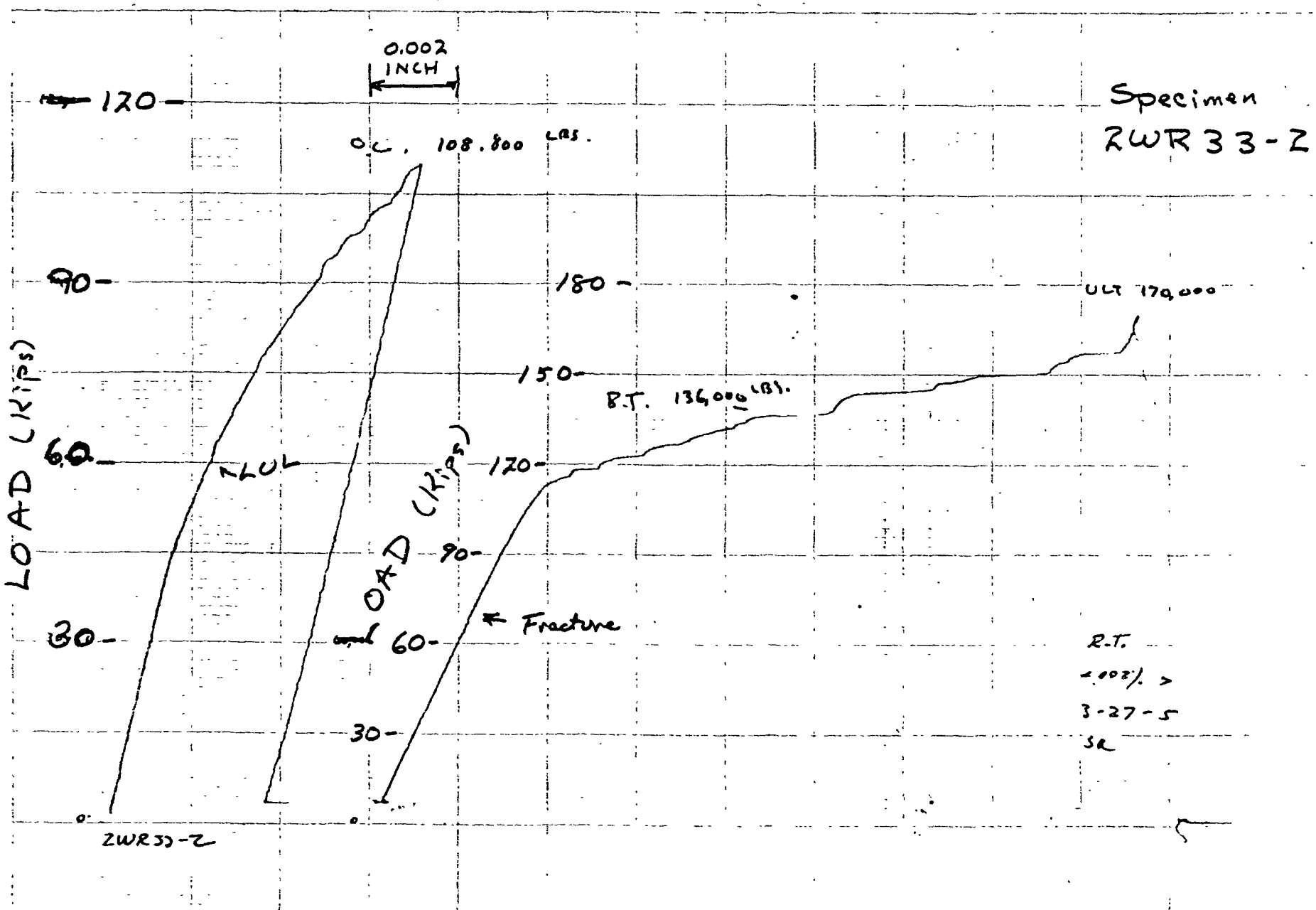

Specimen
3WR31-1
160
140
120
100
80
60
40
20
LOAD (KIPS)
0.002 INCH
PL
UL
BT. 113,800
UCT 143,400
↑ Fracture
3WR31-1
RT.
<.002 >
5-12
GN

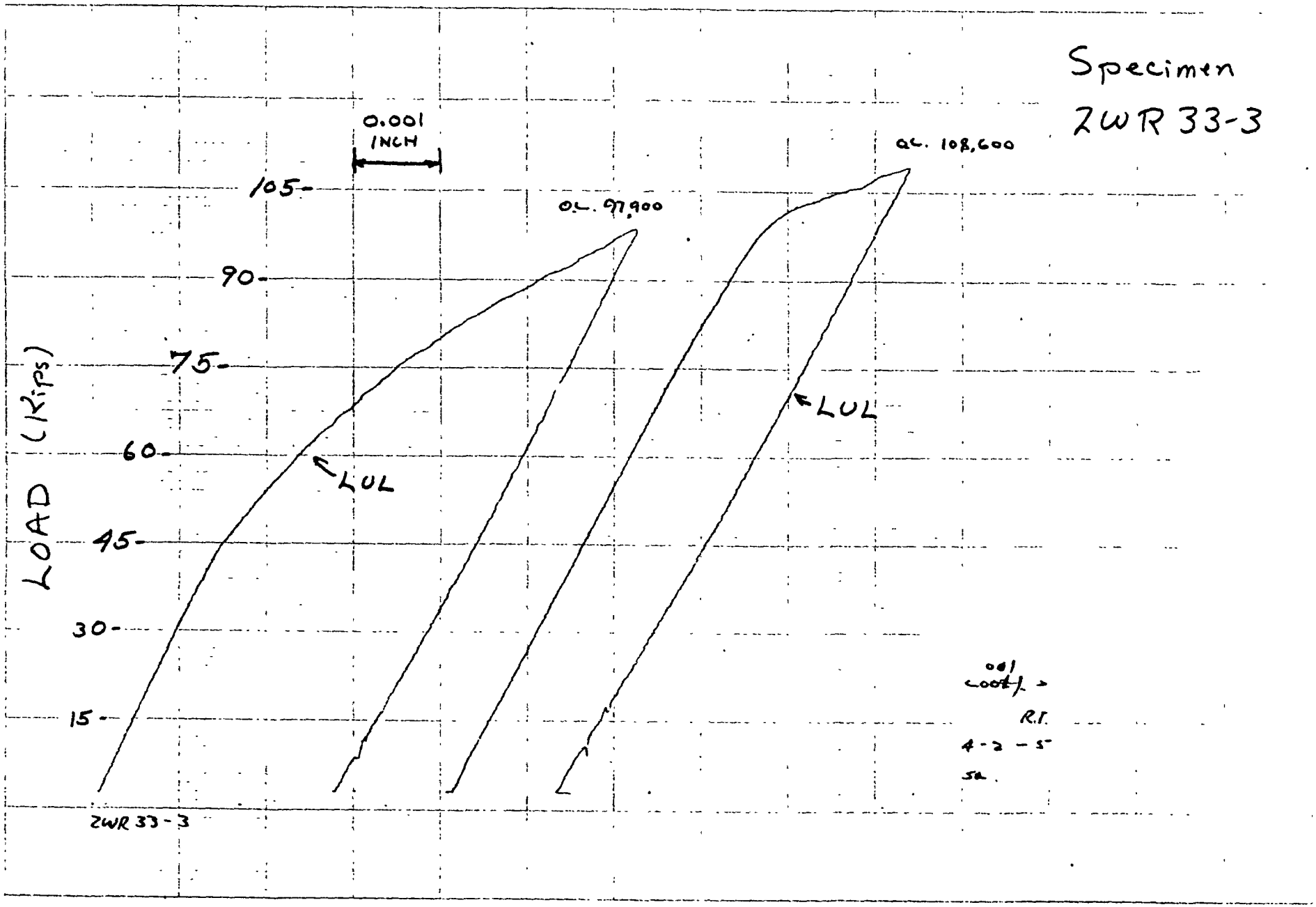

Specimen
3WR 31-2
160-
0.002
INCH
140-
120-
100-
80-
60-
40-
20-
LOAD (KIPS)
Q 106,460
ULT 148,200
Fracture
LUL
3WR 31-2

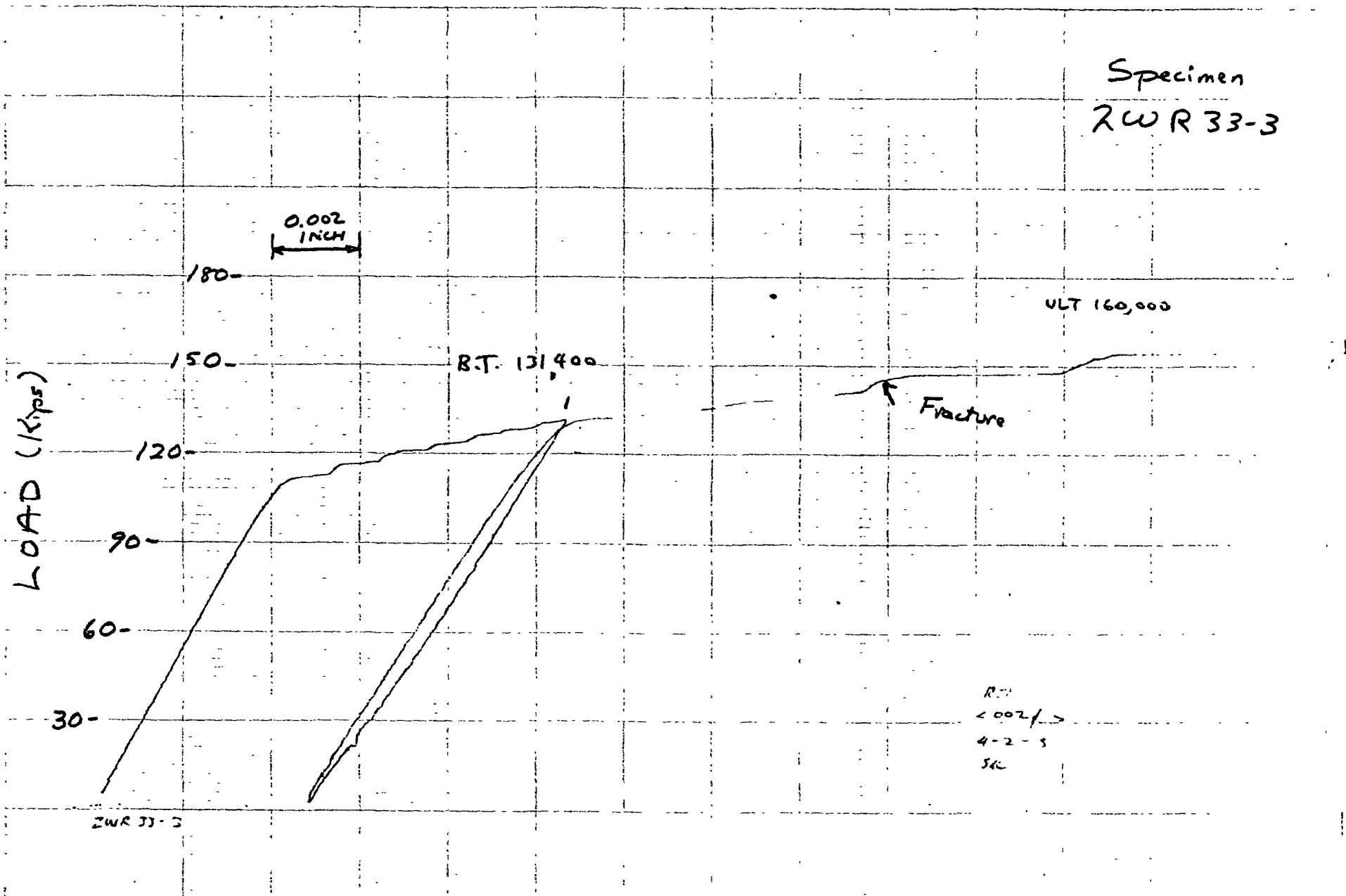

Specimen
4WR31-1
179,010
160
140
120
100
80
60
40
20
LOAD (KIPS)
0.002
INCH
YL
UL
Fracture
R.T.
< 002"/"
5.20-5

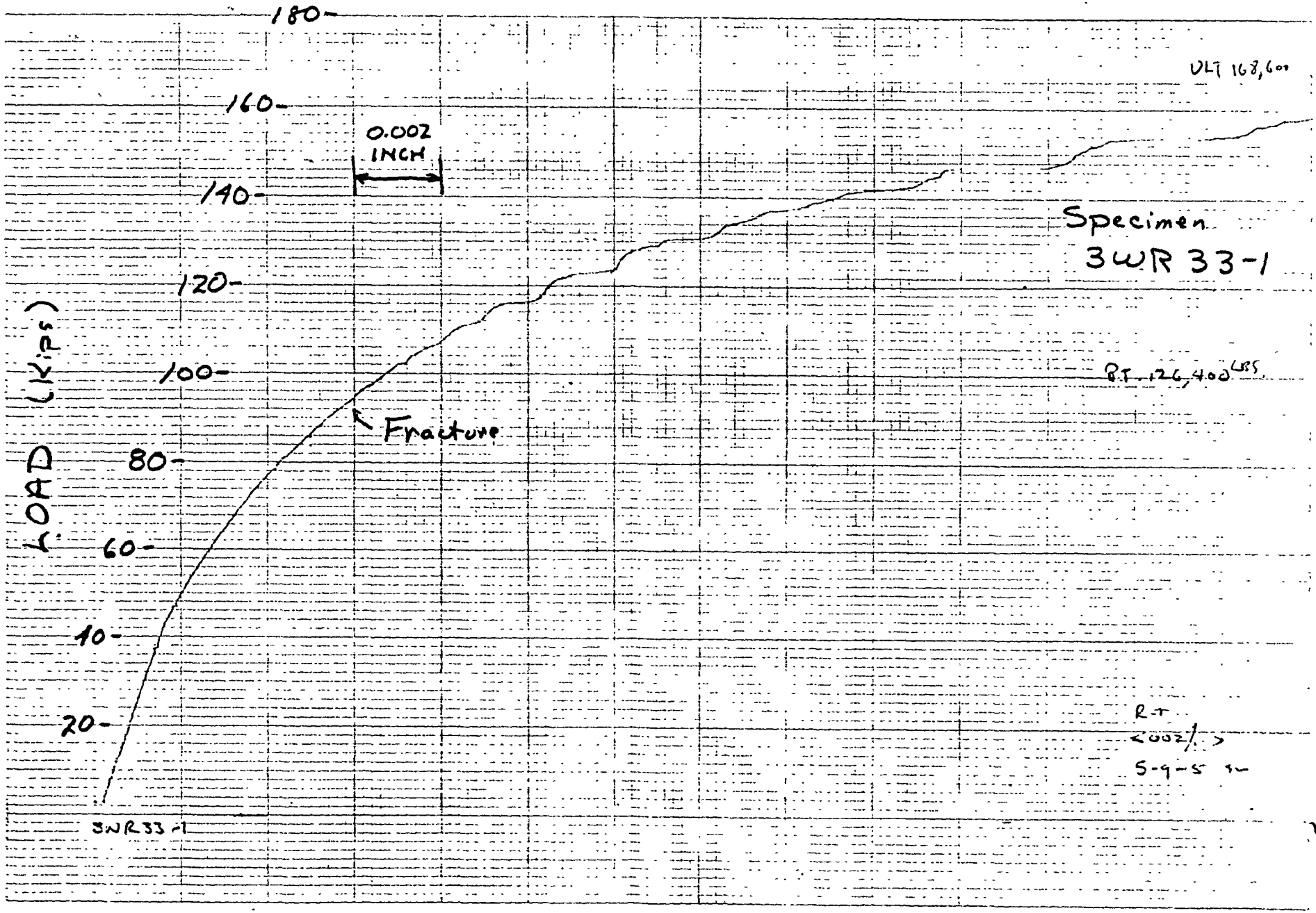

Specimen
4WR31-2
160
140
120
100
80
60
40
20
LOAD (KIPS)
0.002
INCH
PL
Fracture
4WR31-2

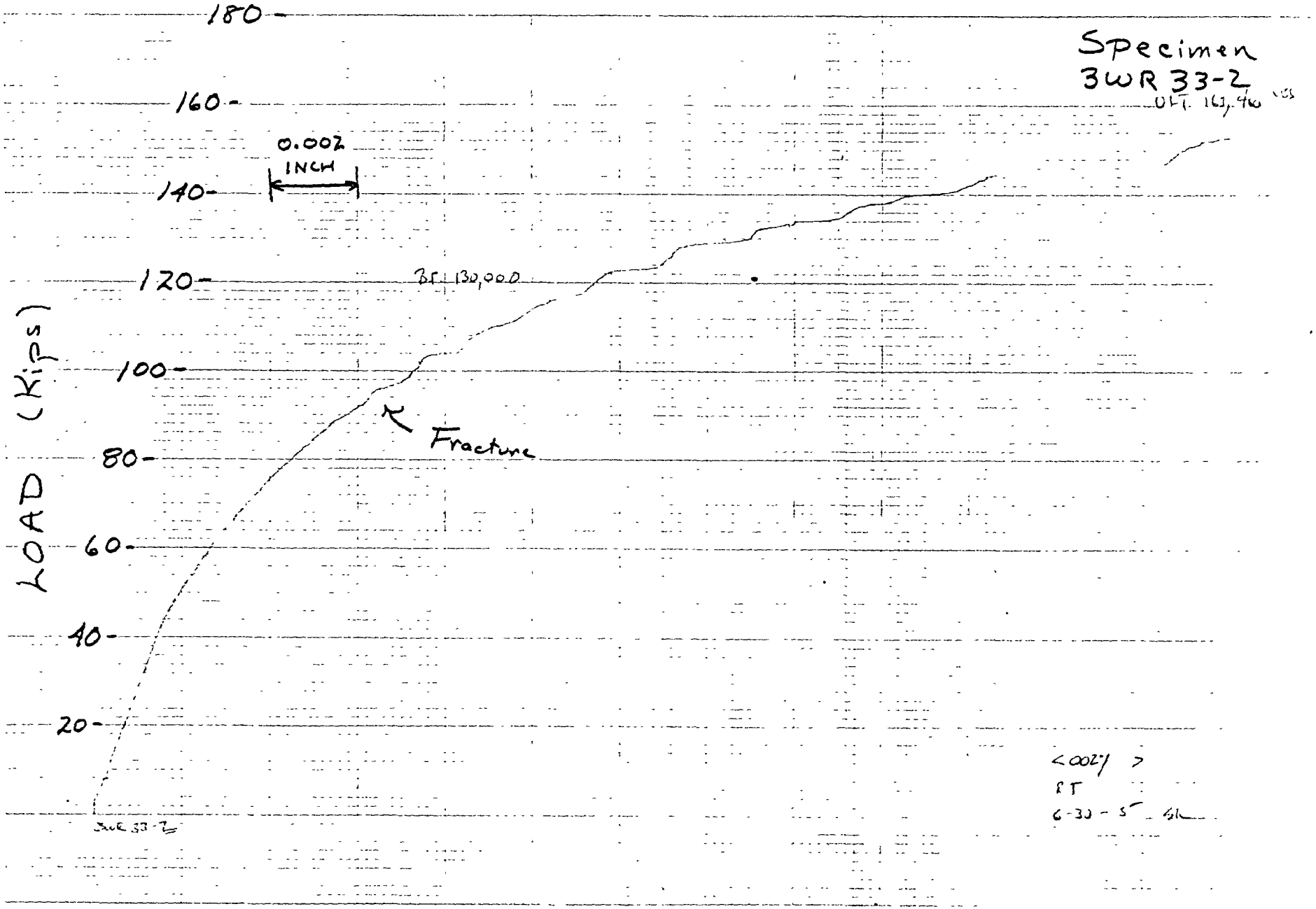

Specimen
2WR33-1
119,700 LBS.
120
105
90
75
60
45
30
15
LOAD (KIPS)
0.002
INCH
PL
LUL
180
150
120
90
60
30
LOAD (KIPS)
Fracture
R.T.
<.002"/in>
2-27-5
2WR33-1

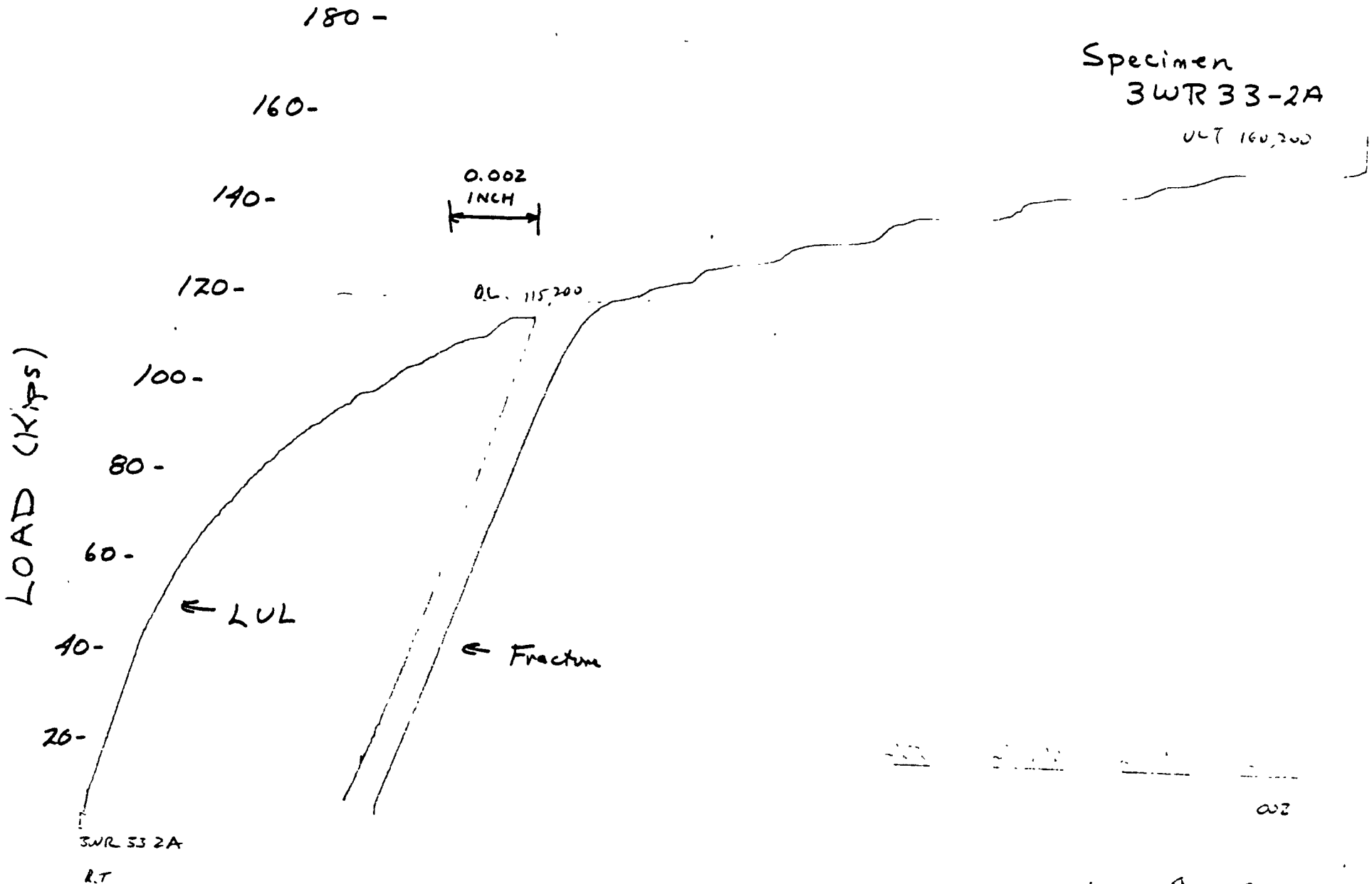

0.002 INCH
Specimen
ZWR33-Z
O.L. 108.800 LBS.
ULT 170,000
B.T. 136,000 (B).
← Fracture
R.T.
<.002% >
3-27-5
SR
LOAD (KIPS)
120
90
60
30
180
150
120
90
60
30
ZWR33-Z

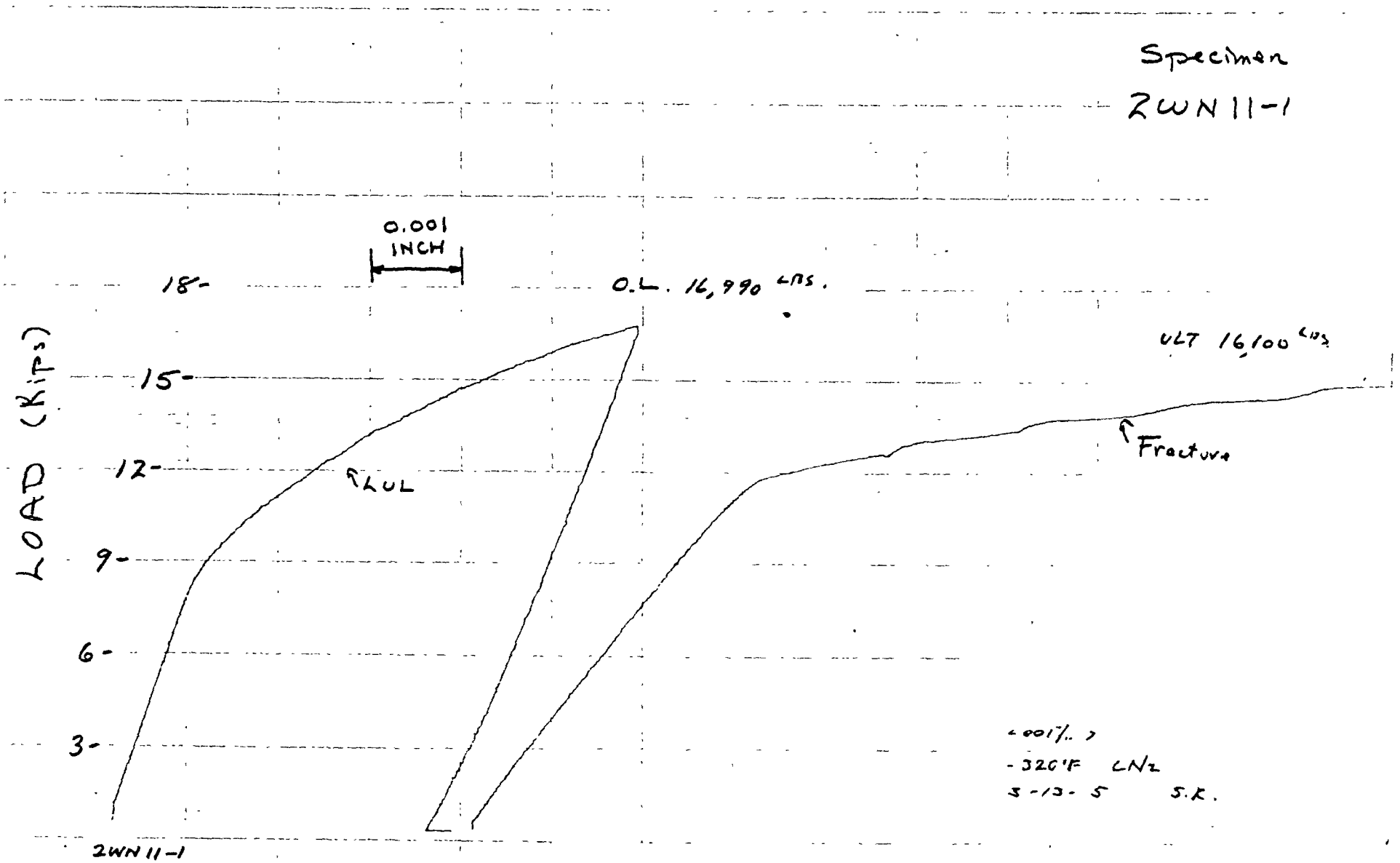

Specimen
2WR 33-3
0.001
INCH
ac. 108,600
ac. 97,900
105
90
75
60
45
30
15
LOAD (KIPS)
LUL
LUL
2WR 33-3
R.T.

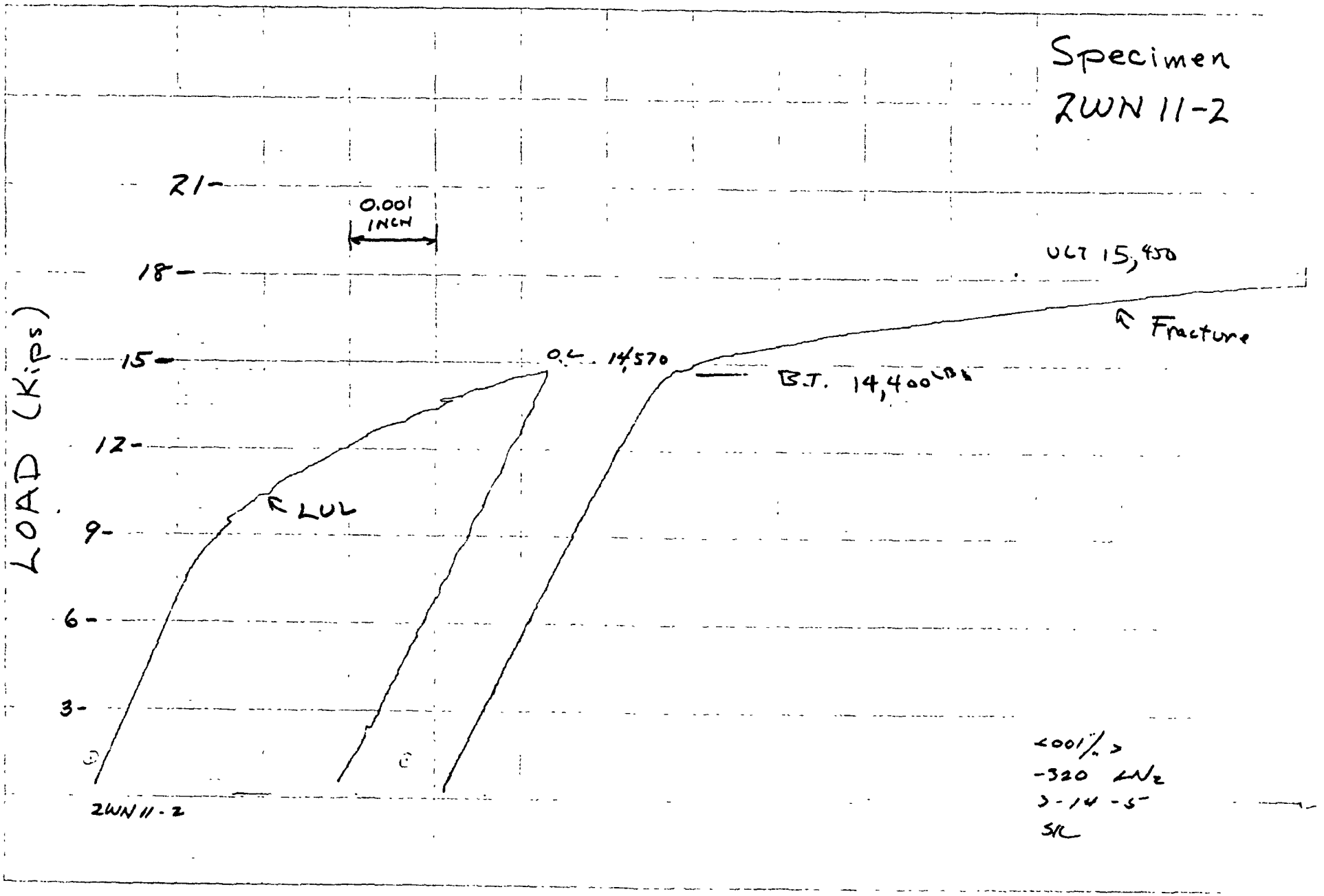

Specimen
2WR 33-3
0.002 INCH
180
150
120
90
60
30
LOAD (Kips)
B.T. 131,400
ULT 160,000
Fracture
2WR 33-3

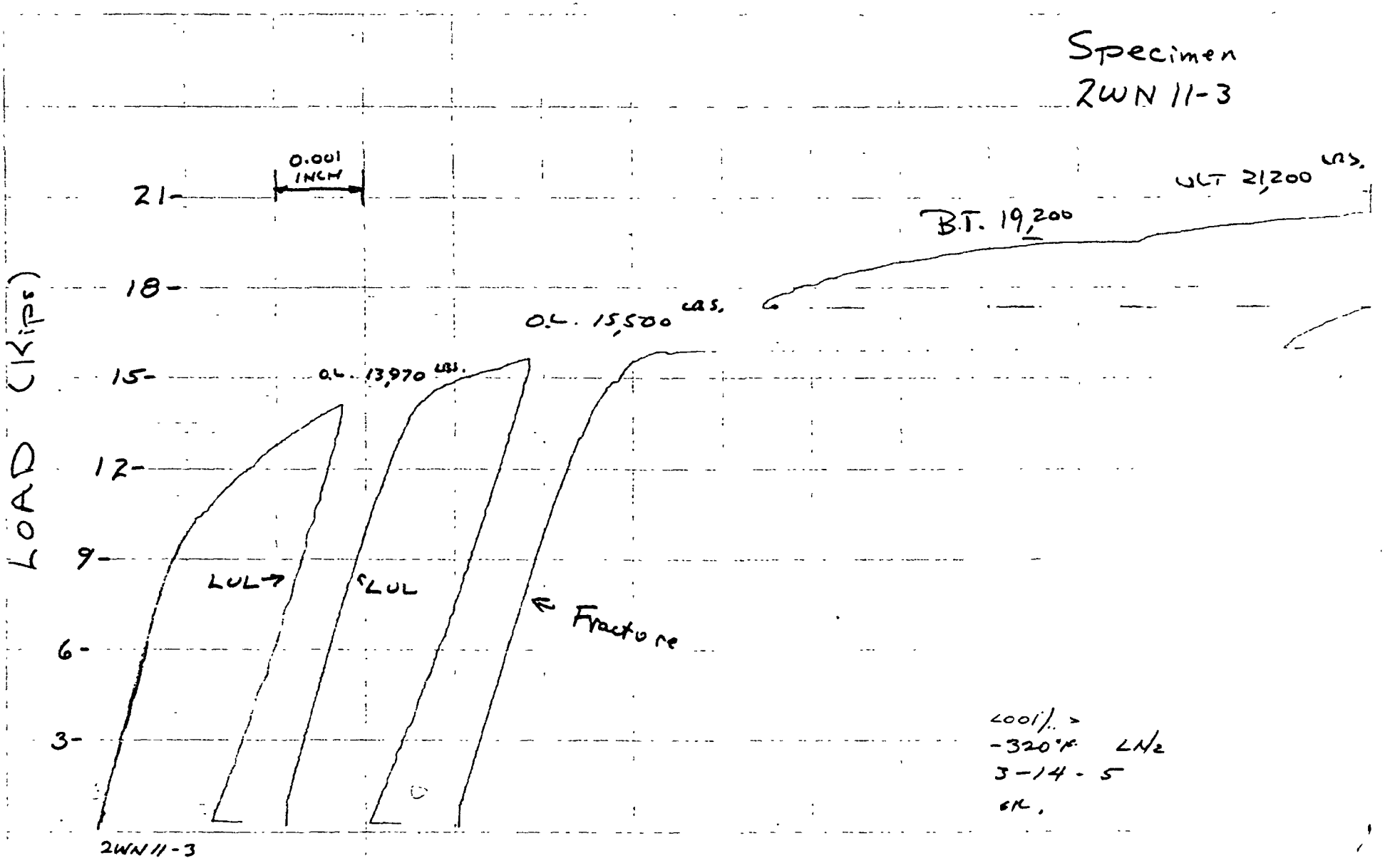

180
160
140
120
100
80
60
40
20
LOAD (Kips)
0.002 INCH
Fracture
ULT 168,600
Specimen
3WR 33-1
RT 126,400 LBS
R+
<.002/.>
5-9-5
3WR33-1

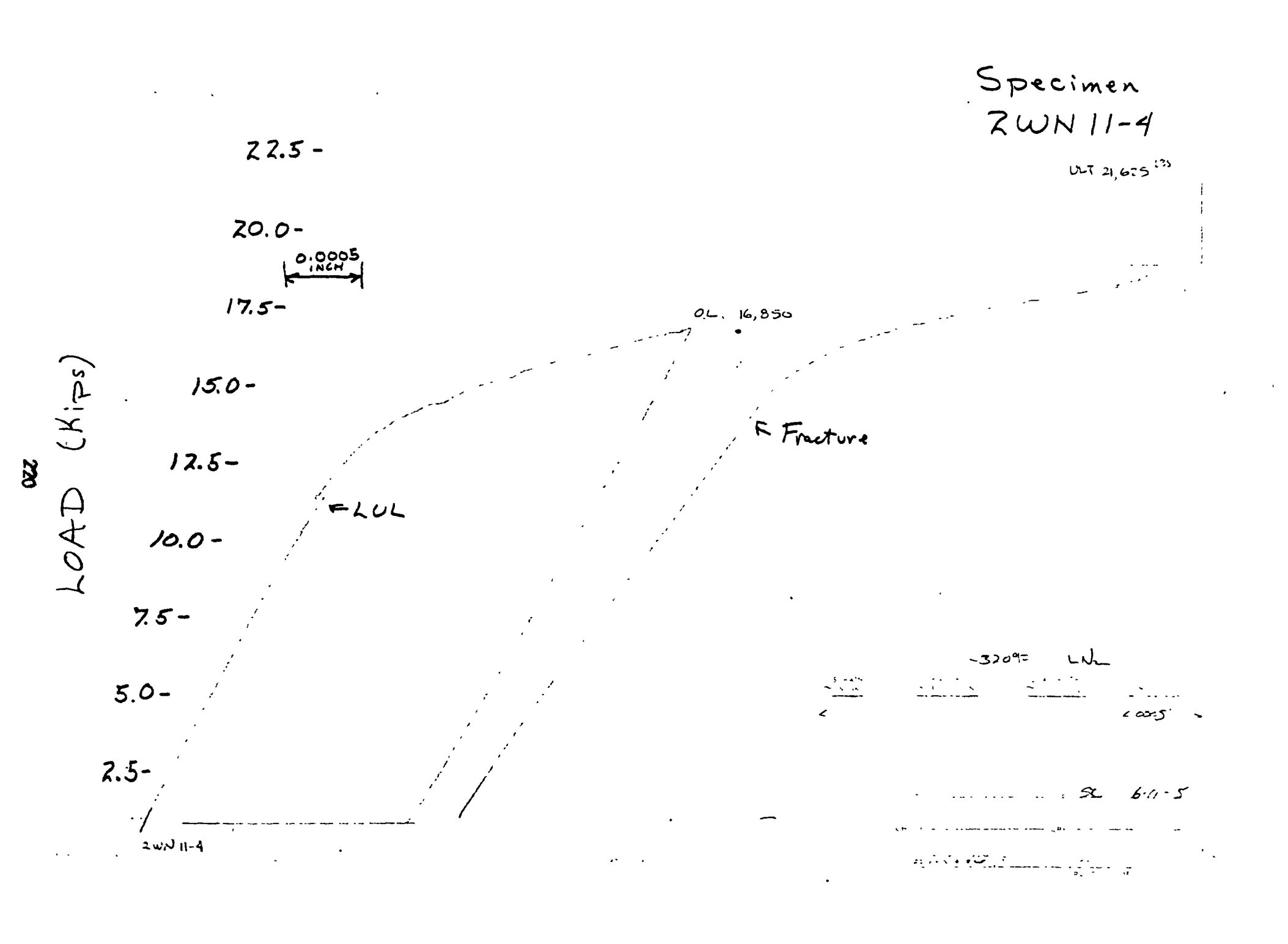

Specimen
3WR 33-2
Ult. 163,400 lbs
0.002
INCH
Sr 130,000
Fracture
LOAD (Kips)
180
160
140
120
100
80
60
40
20
3WR 33-2
<.002" >
RT
6-30-5

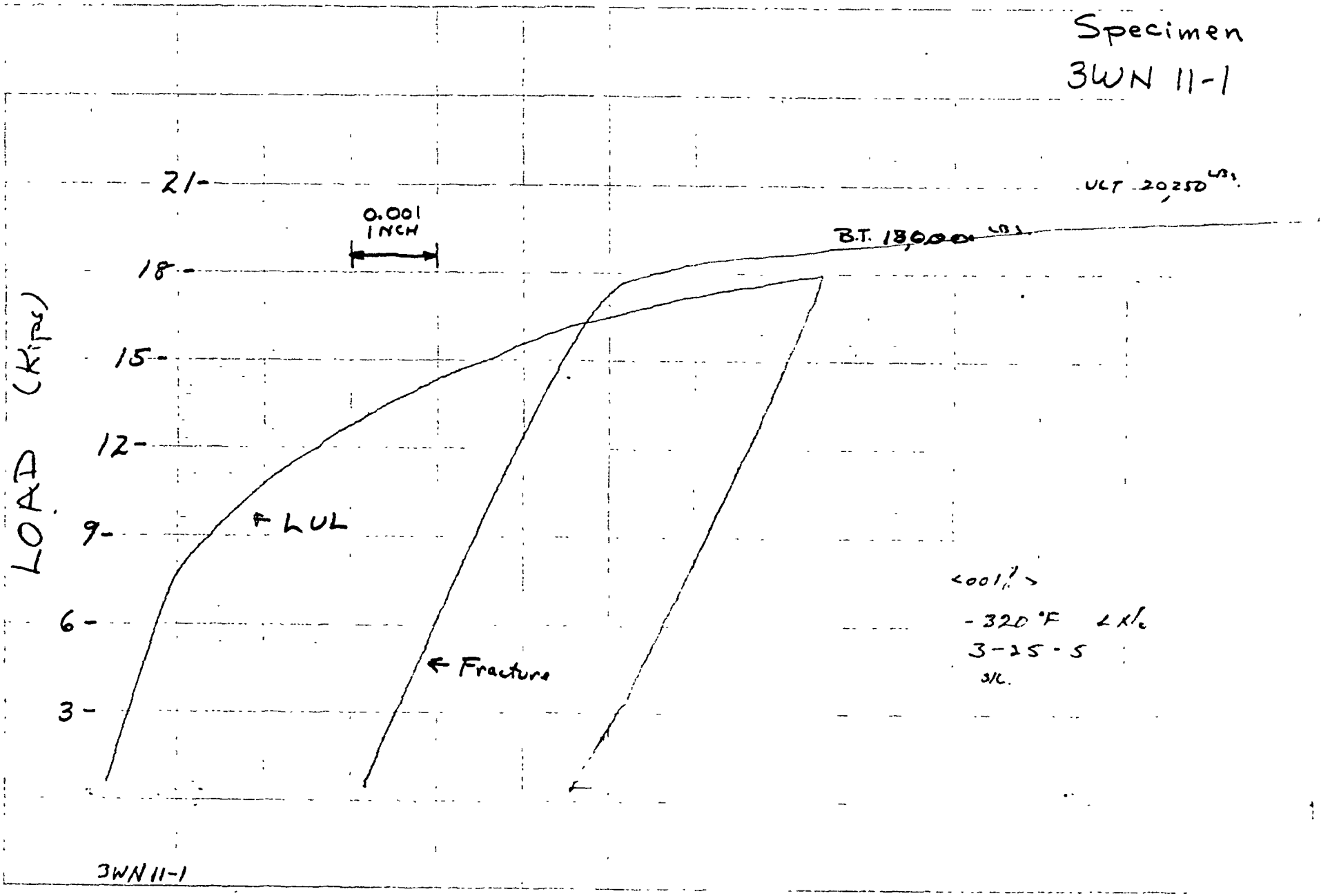

Specimen
3WR33-2A
ULT 160,200
0.002
INCH
0.L. 115,200
LOAD (KIPS)
180
160
140
120
100
80
60
40
20
← LUL
← Fracture
3WR 33 2A
R.T

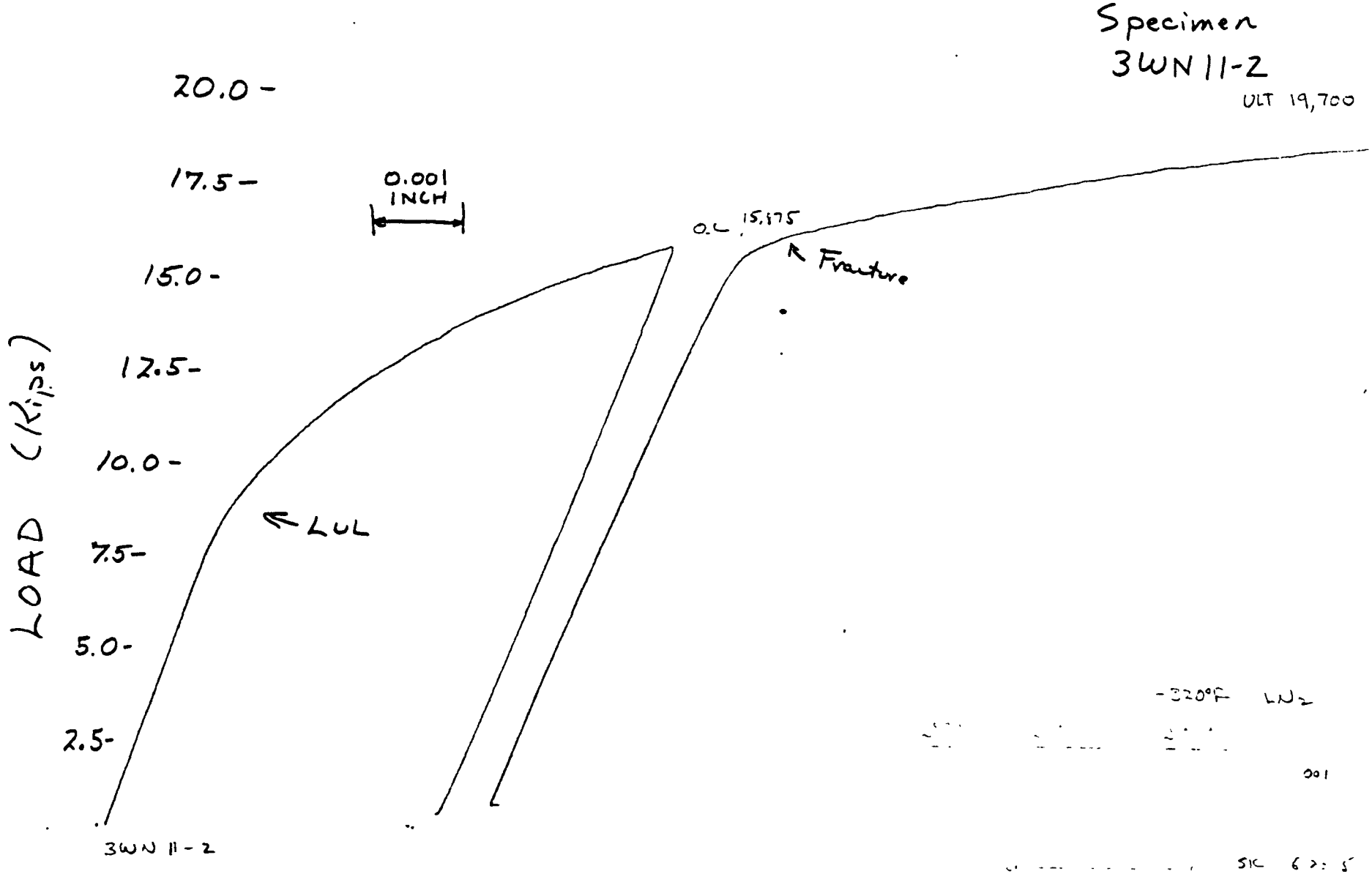

Specimen
2WN11-1
0.001
INCH
18-
15-
12-
9-
6-
3-
LOAD (KIPS)
O.L. 16,990 LBS.
ULT 16,100 LBS
LUL
Fracture
<001"..>
-320°F LN2
3-13-5 S.K.
2WN11-1


Specimen
2WN 11-2
21
18
15
12
9
6
3
LOAD (KIPS)
0.001
INCH
ULT 15,450
Fracture
0.L. 14,570
B.J. 14,400 LBS
LUL
2WN 11-2
<001>
-320 LN2
3-14-5
SRL

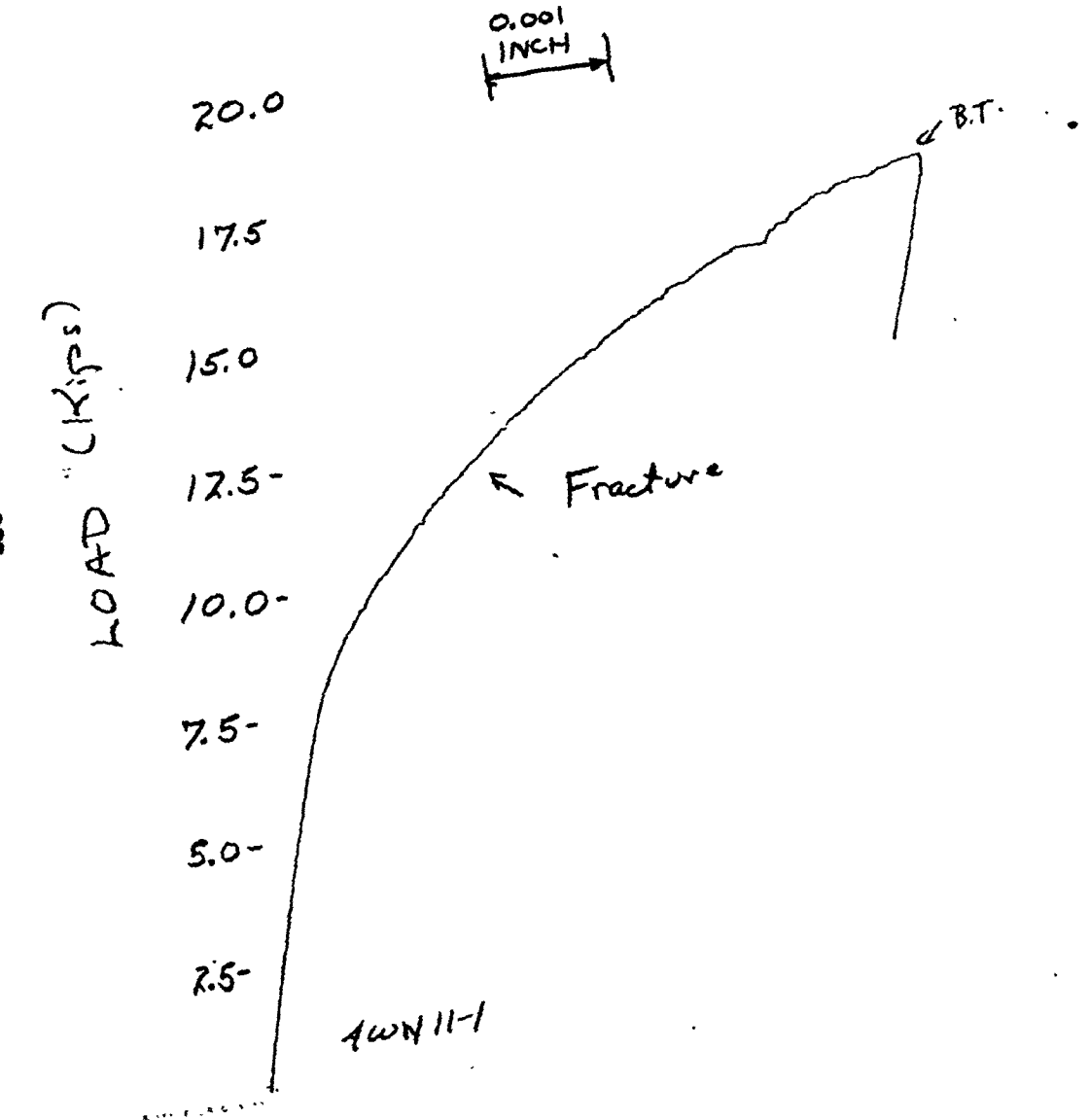

Specimen
2WN 11-3
0.001 INCH
21
18
15
12
9
6
3
LOAD (KIPS)
B.T. 19,200
ULT 21,200 LBS.
O.L. 15,500 LBS.
O.L. 13,970 LBS.
LUL
LUL
Fracture
<001>
-320°F LN2
3-14-5
GK.
2WN 11-3


Specimen
2WN 11-4
ULT 21,675 lbs
22.5
20.0
0.0005 INCH
17.5
15.0
12.5
10.0
7.5
5.0
2.5
LOAD (KIPS)
OL. 16,850
F Fracture
LOL
2WN 11-4
-320#
LNL
.0005
SL 6.11-5

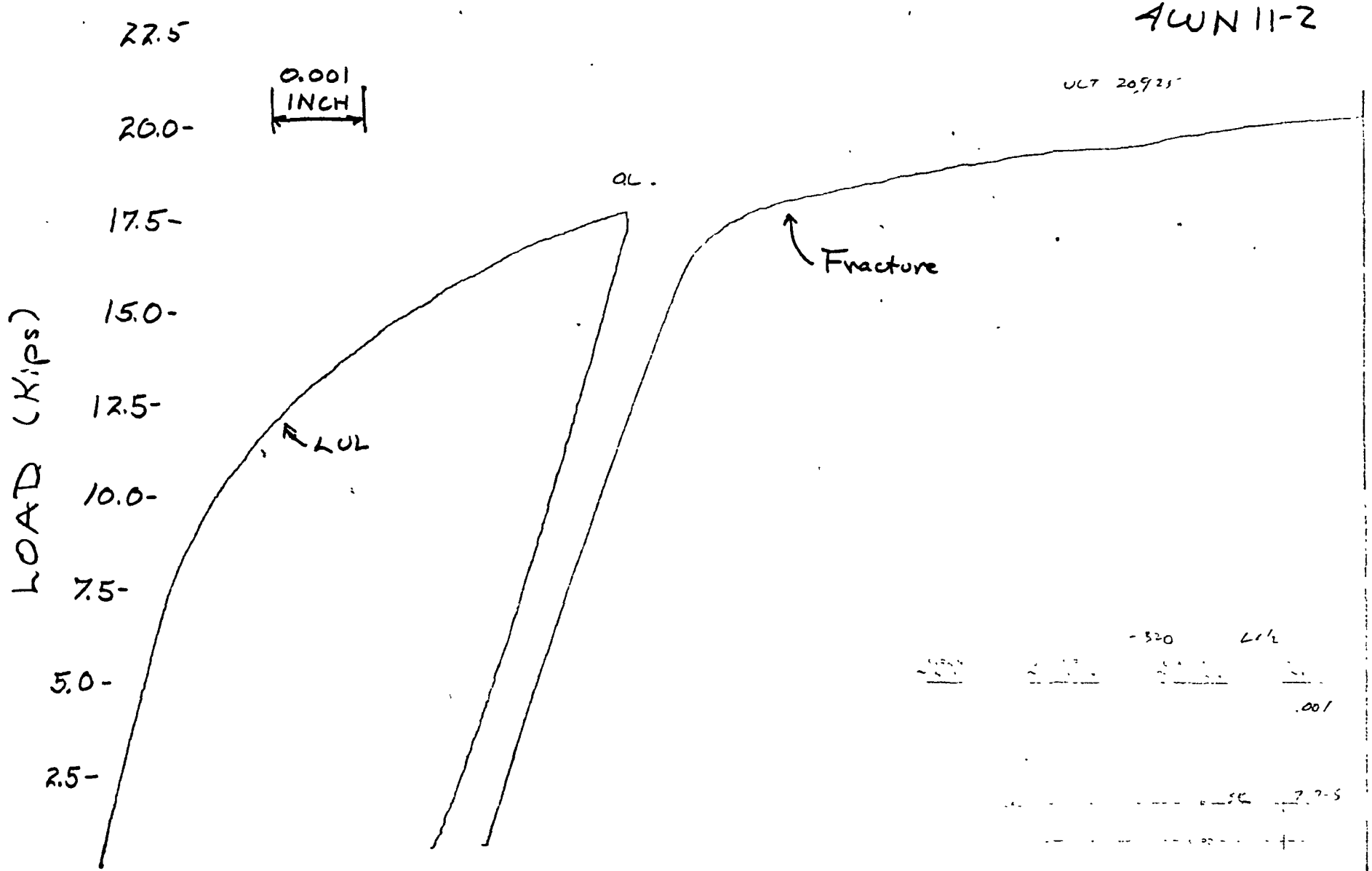

Specimen
3WN 11-1
21
18
15
12
9
6
3
LOAD (Kips)
0.001
INCH
B.T. 18,000 lbs.
ULT 20,250 lbs.
← LUL
← Fracture
<001>
-320 °F
3-25-5
S/C.
3WN 11-1

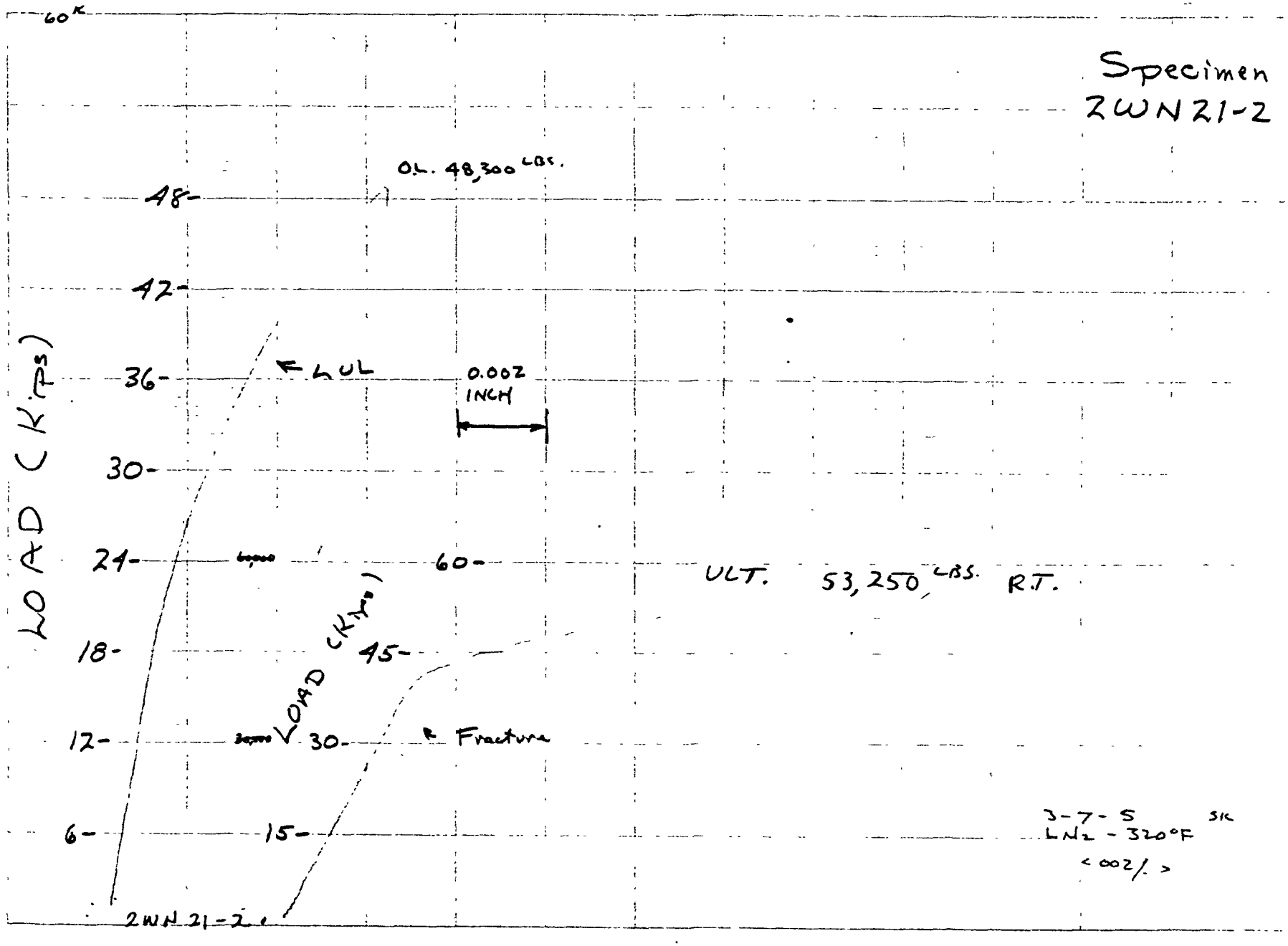

Specimen
3WN11-2
ULT 19,700
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
LOAD (Kips)
0.001
INCH
0.L 15,175
Fracture
LUL
3WN 11-2
-320°F LN2

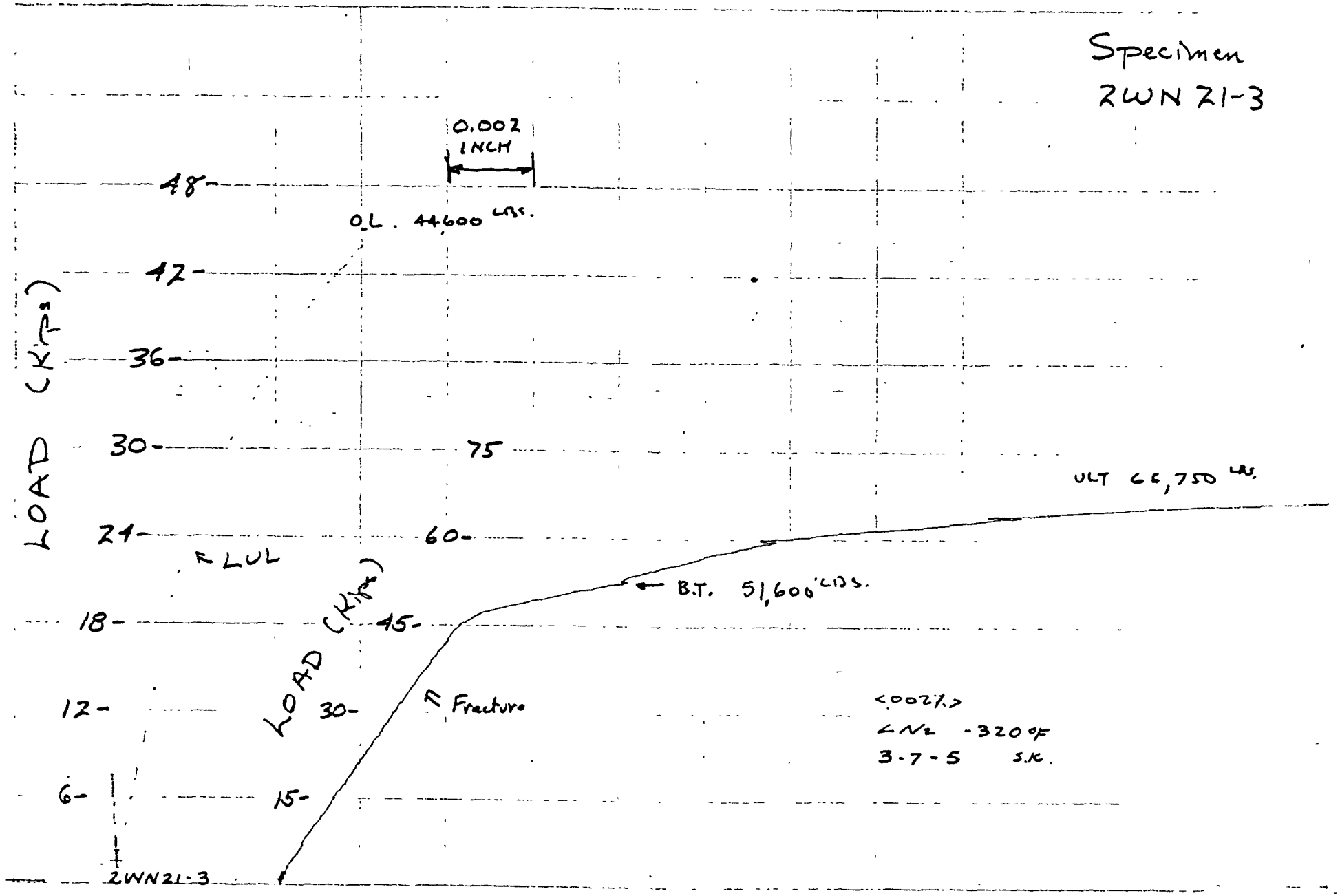
Specimen
4WN 11-1



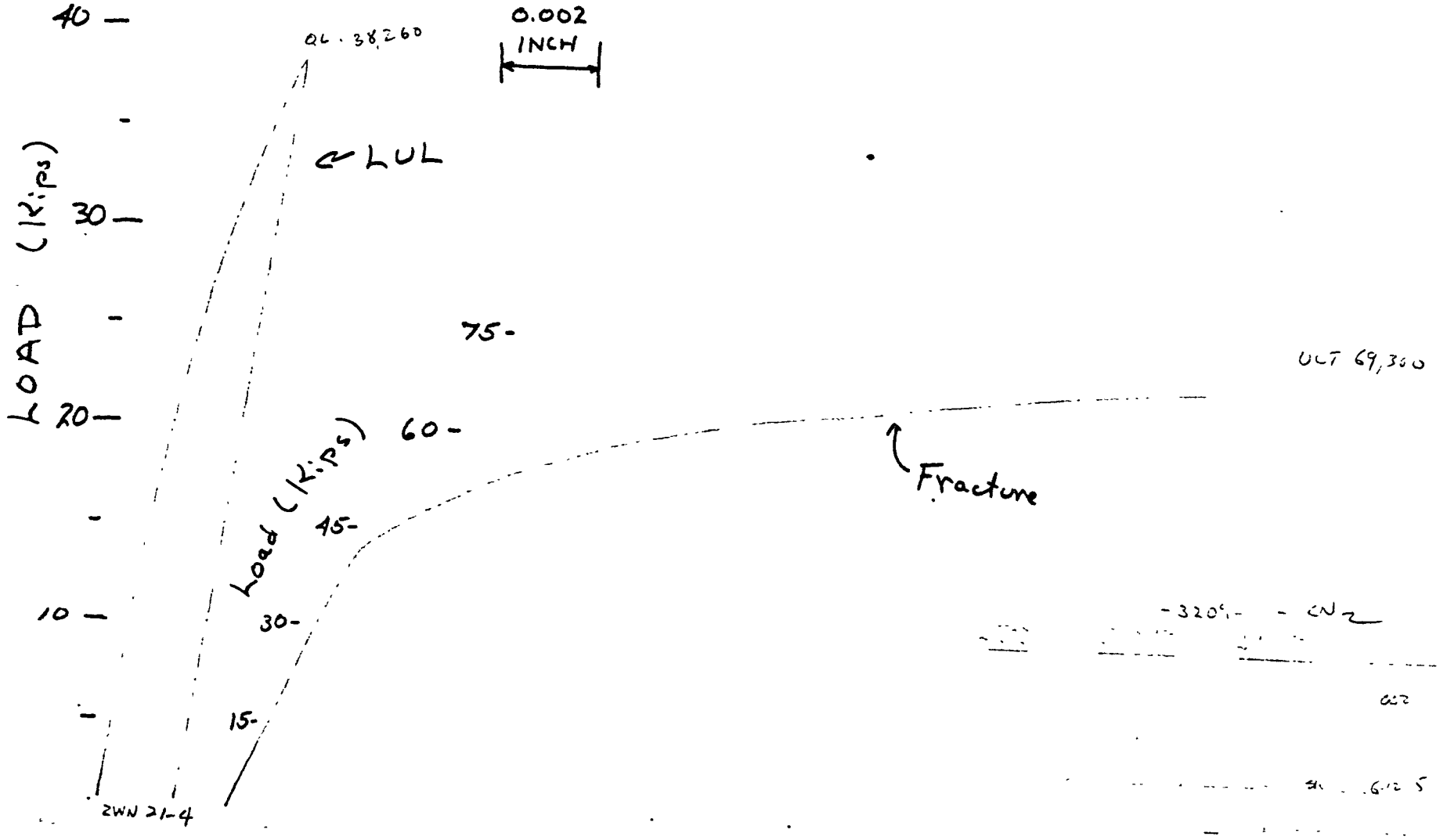
Specimen
4UN 11-2

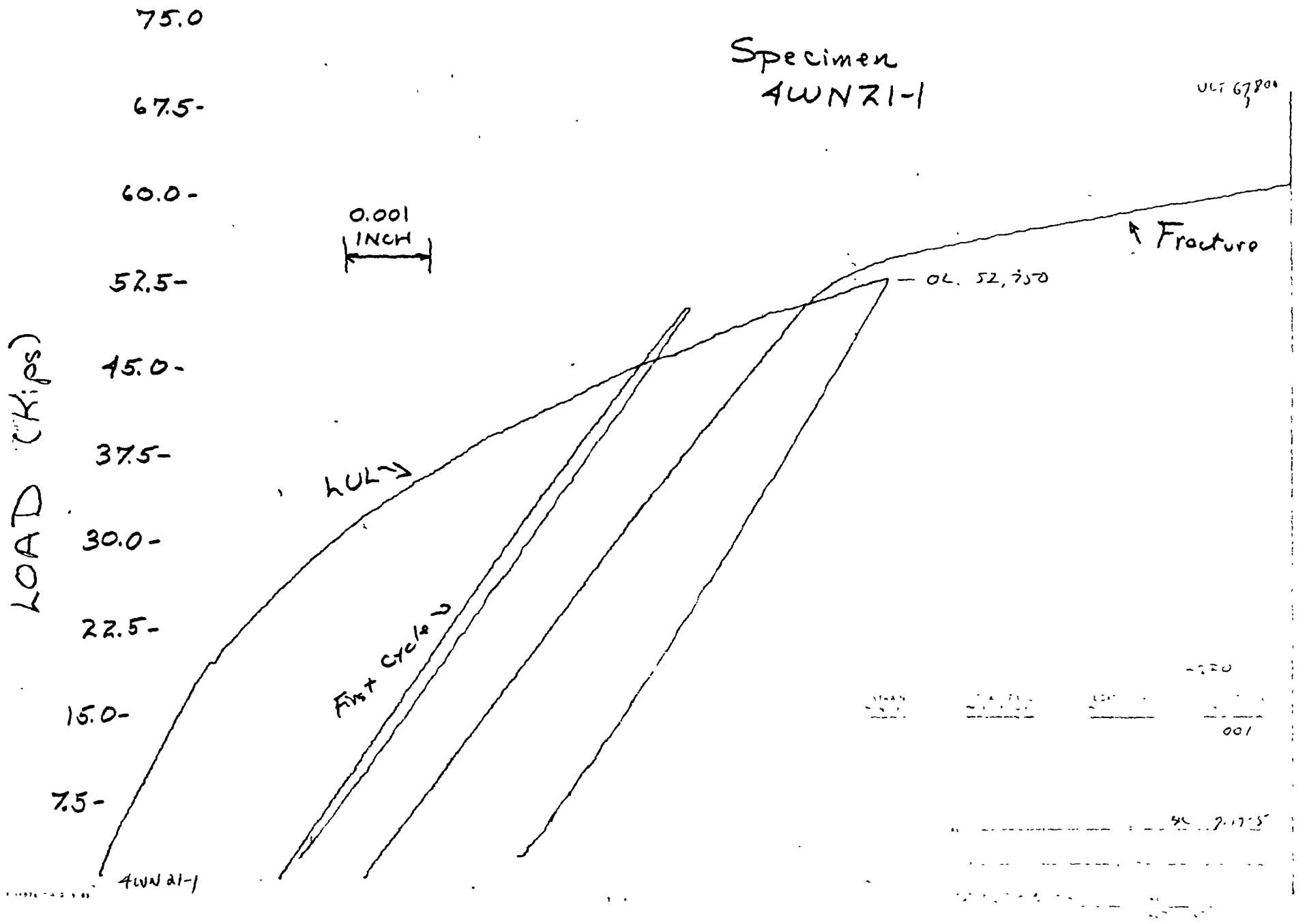


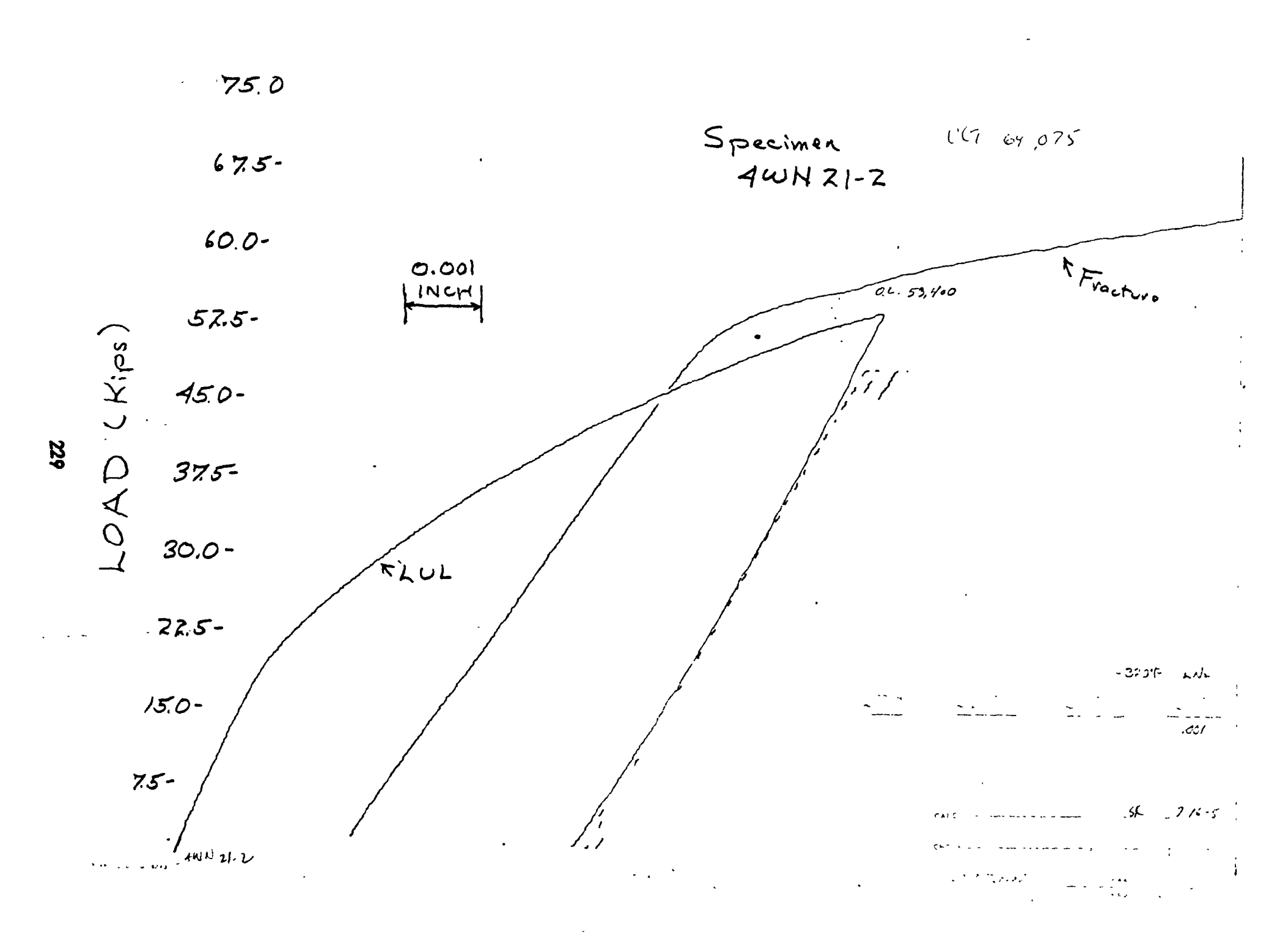

60K
Specimen
2WN21-2
OL. 48,300 LBS.
48
42
36
30
24
18
12
6
LOAD (KIPS)
LUL
0.002
INCH
60
45
30
15
LOAD (KIPS)
ULT. 53,250 LBS. R.T.
Fracture
2WN 21-2
3-7-5
LN2 - 320°F
<.002/.>

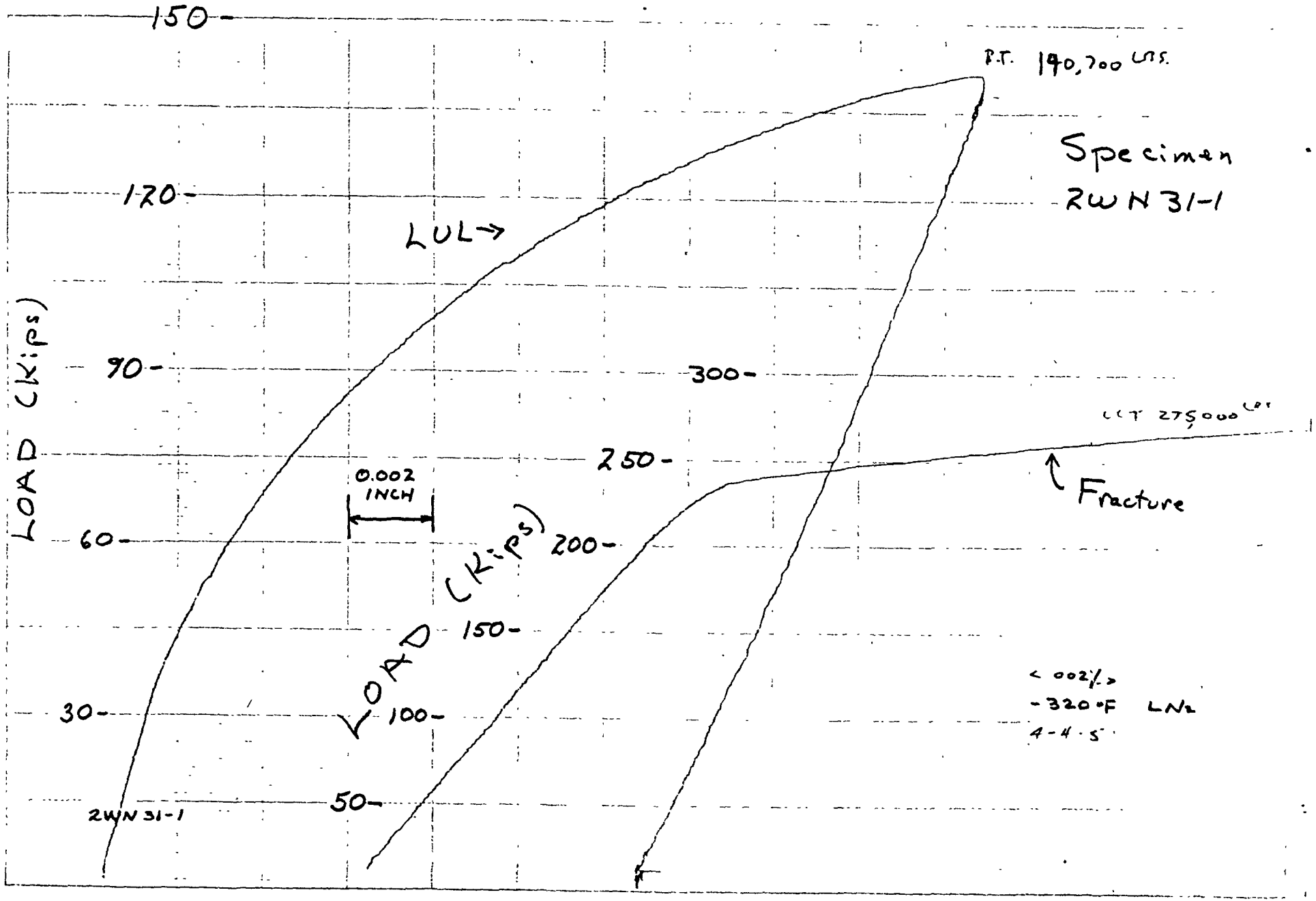

Specimen
2WN21-3
0.002
INCH
48
42
36
30
24
18
12
6
LOAD (KIPS)
O.L. 44,600 LBS.
LUL
75
60
45
30
15
LOAD (KIPS)
B.T. 51,600 LBS.
ULT 66,750 LBS.
Fracture
<.002"/>
∠N2 -320°F
3-7-5 S.K.
2WN21-3

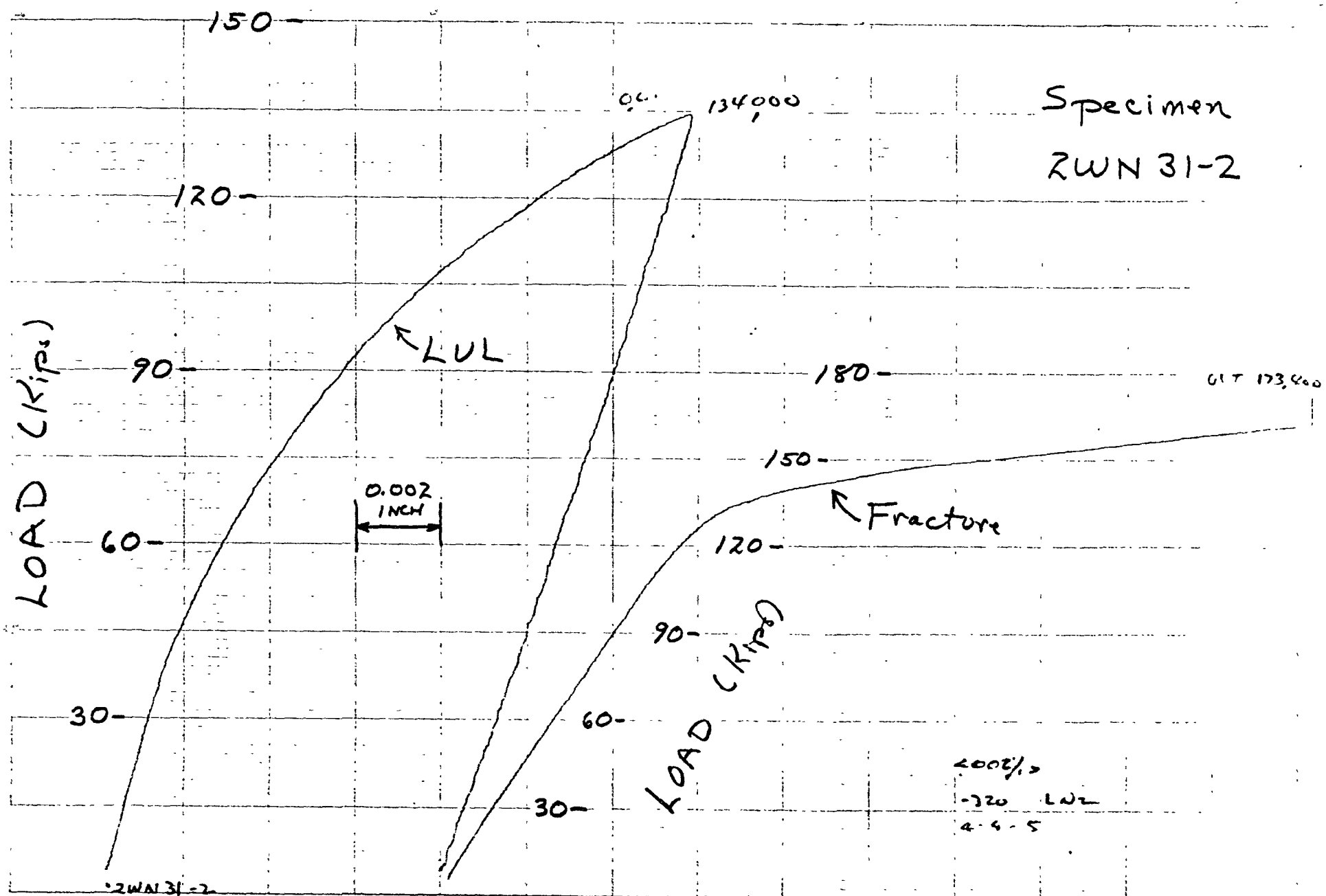
Specimen
2WN 21-4

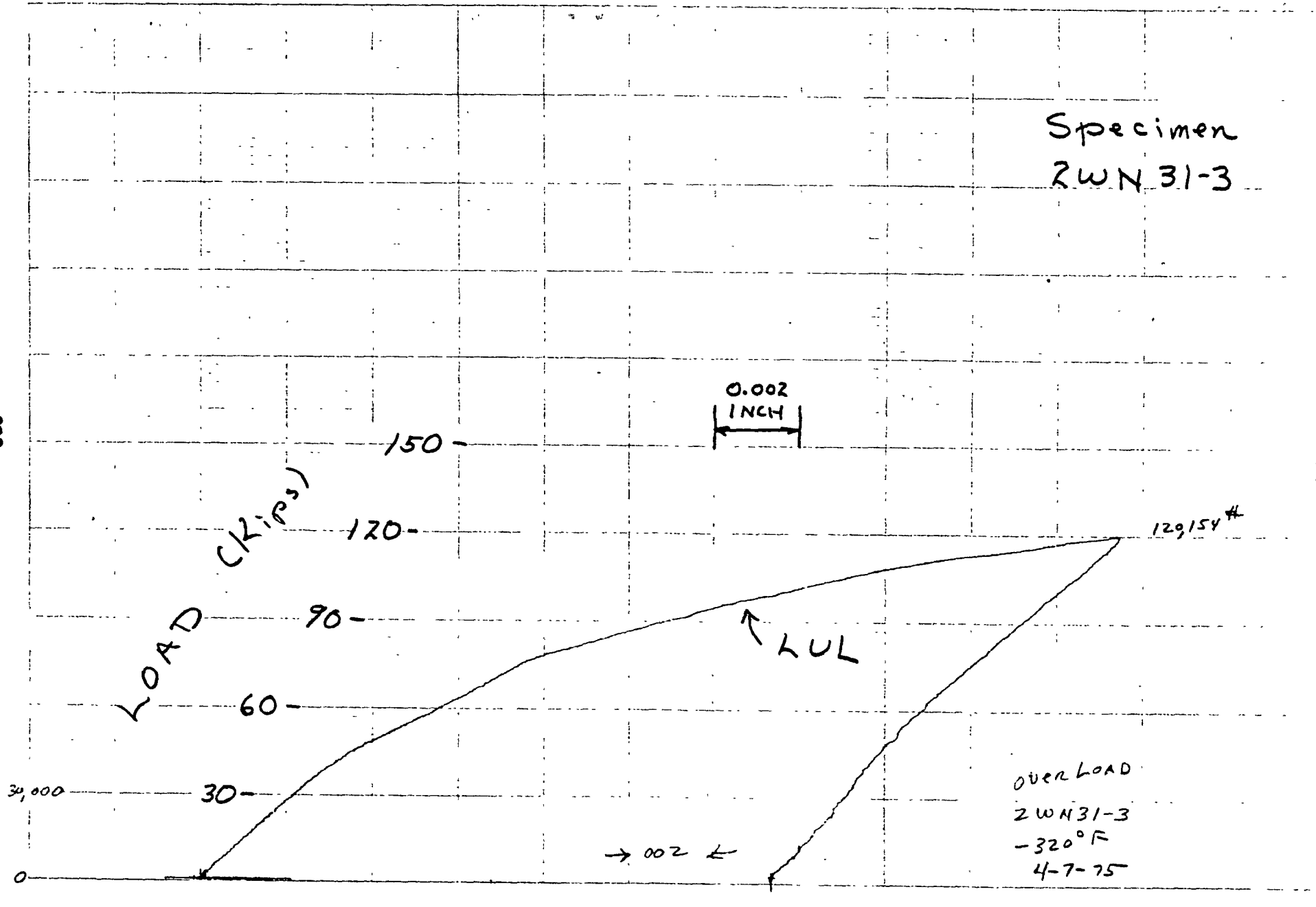


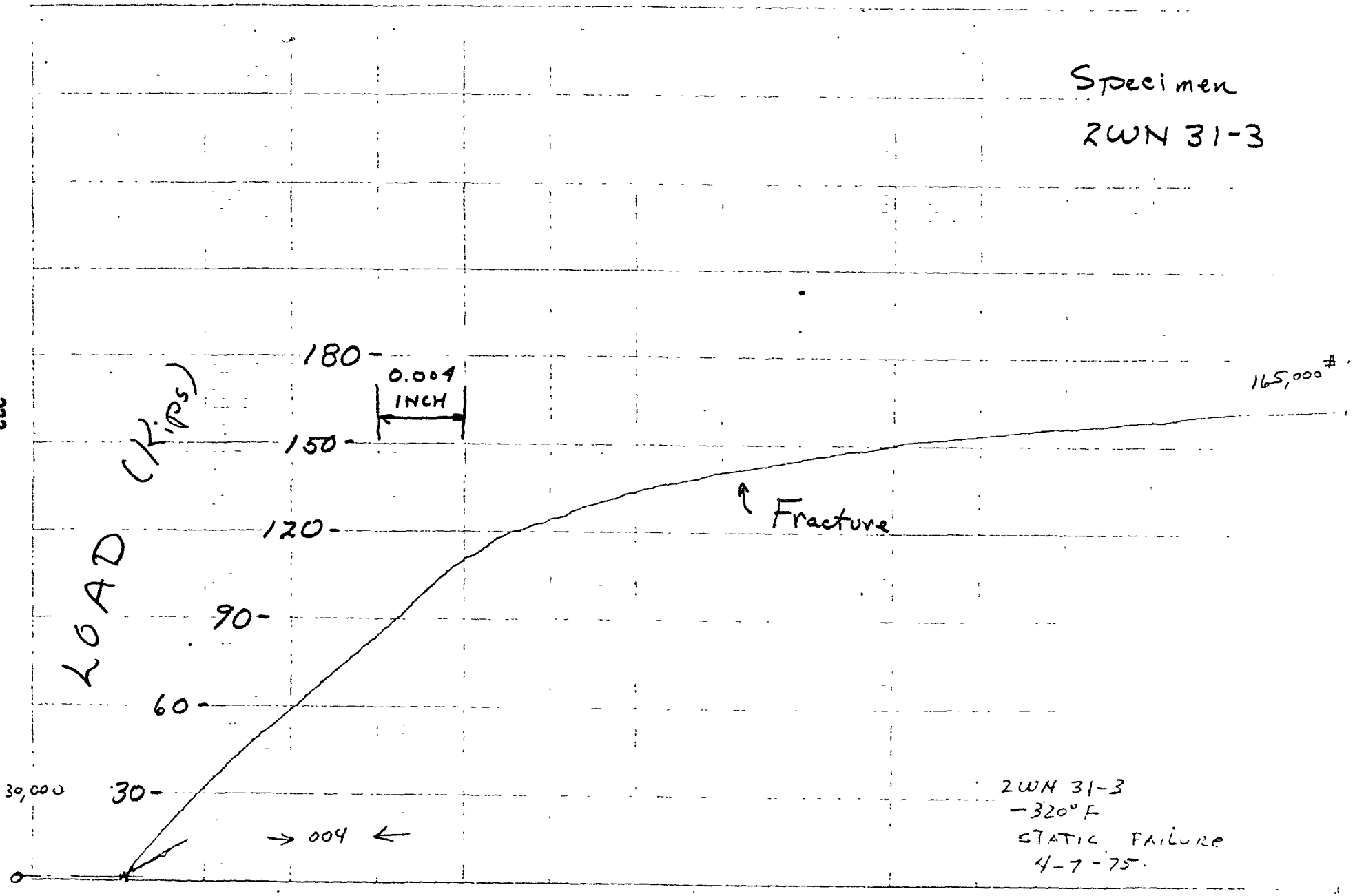

Specimen
4WN21-1
ULT 67,800
0.001
INCH
Fracture
OL. 52,750
LOAD (Kips)
75.0
67.5
60.0
52.5
45.0
37.5
30.0
22.5
15.0
7.5
4WL
First cycle
4WN 21-1

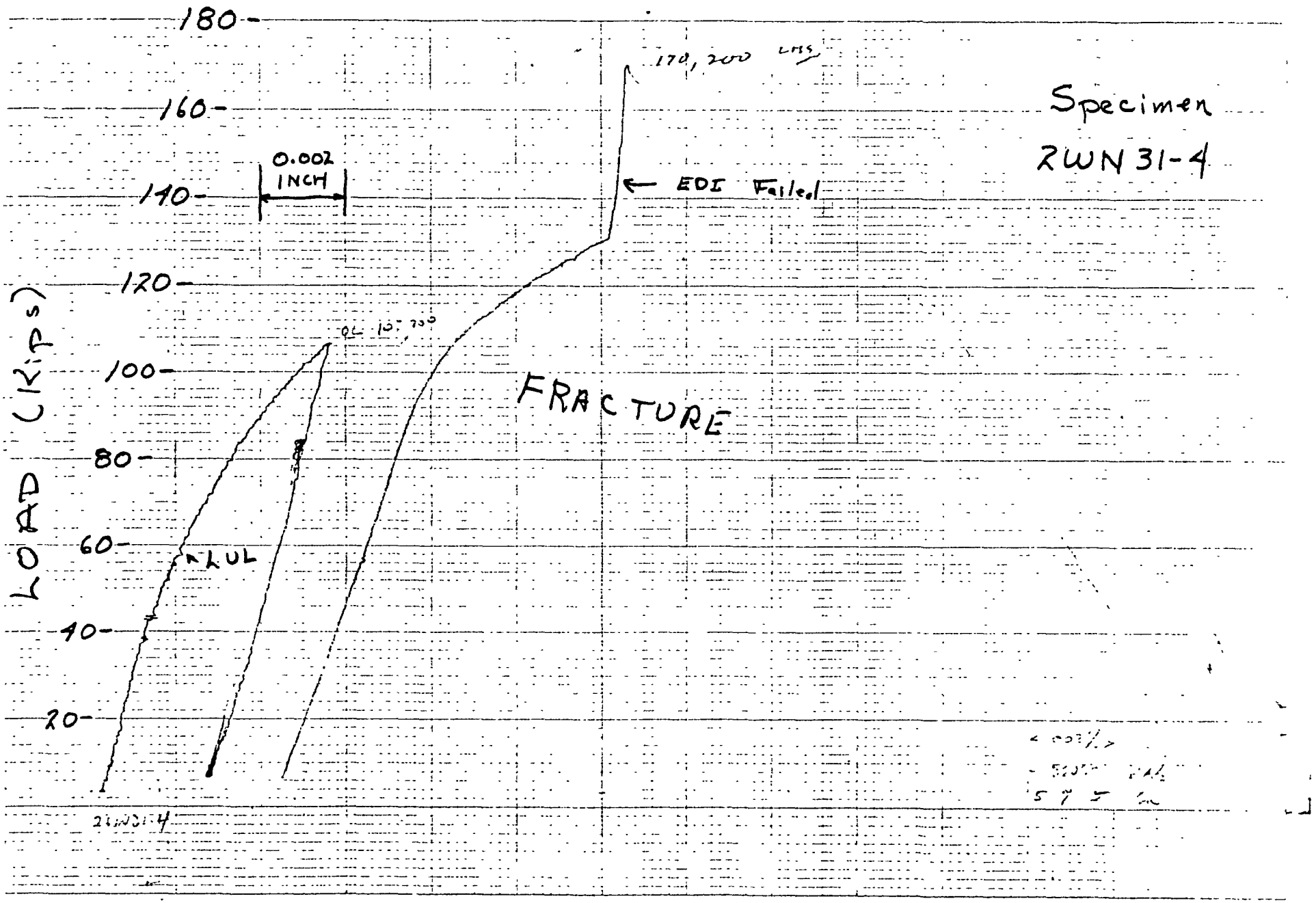

Specimen
4WN 21-2
LCT 64,075
0.001
INCH
LOAD (Kips)
75.0
67.5
60.0
52.5
45.0
37.5
30.0
22.5
15.0
7.5
LUL
QL. 53,400
Fracture
4WN 21-2

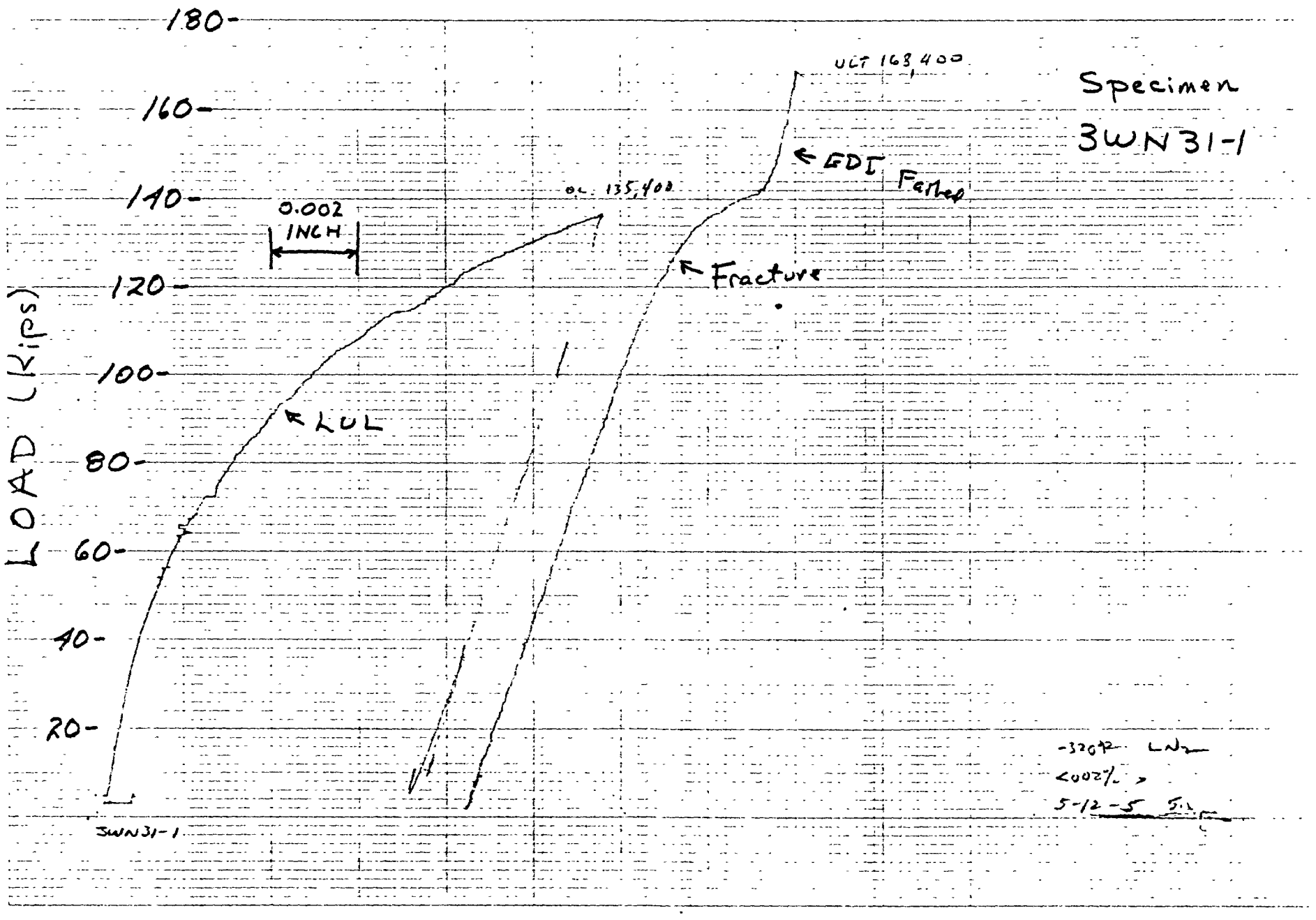

150
120
90
60
30
LOAD (Kips)
LUL→
0.002 INCH
2WN 31-1
P.T. 190,700 LBS.
Specimen
2WN 31-1
300
250
200
150
100
50
LOAD (Kips)
U.T. 275,000 LBS
Fracture
< 002%
-320°F LN2
4-4-5

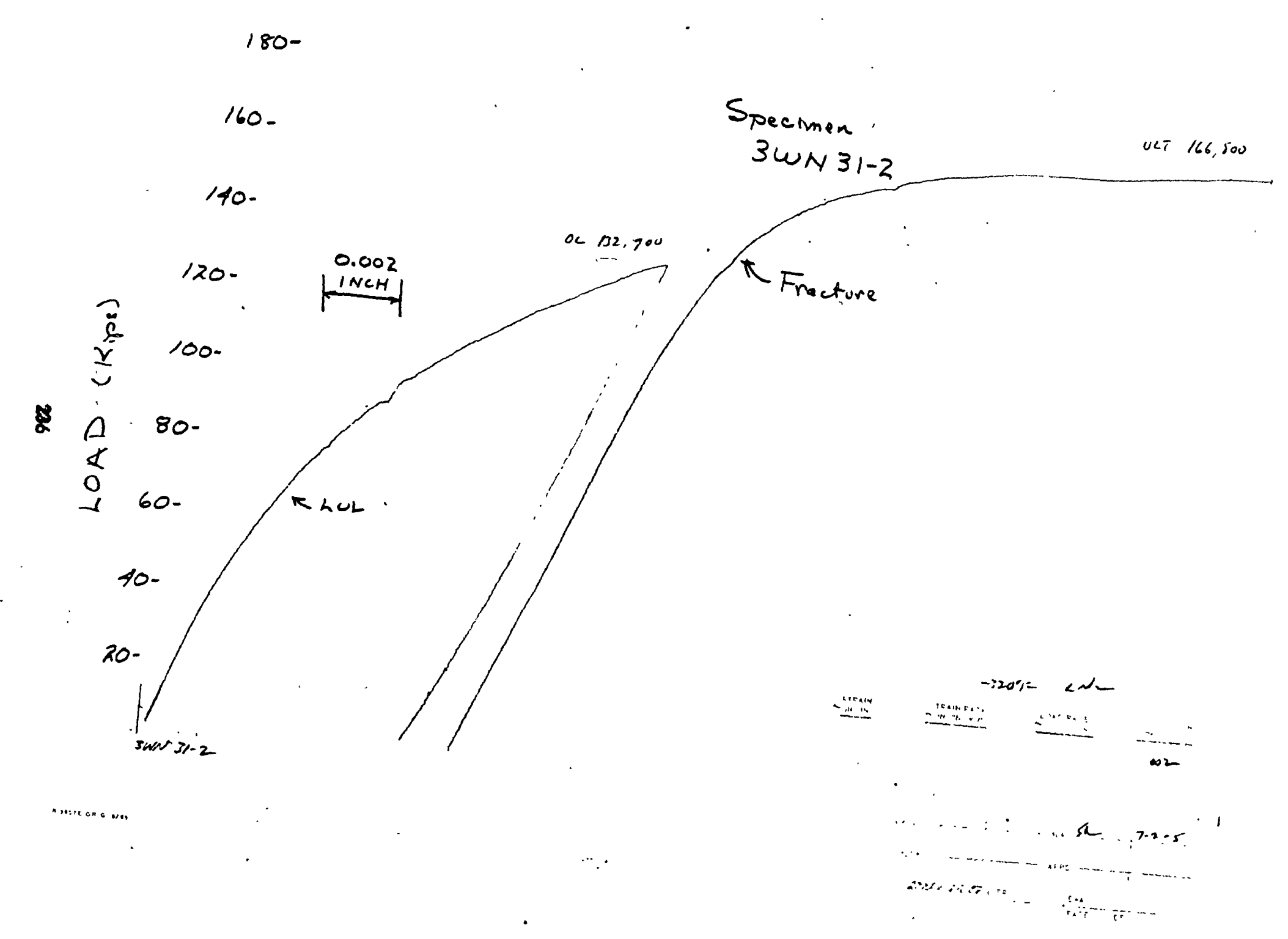

Specimen
2WN 31-2
LOAD (Kips)
150
120
90
60
30
LUL
0.002
INCH
134,000
180
150
120
90
60
30
Fracture
LOAD (Kips)
173,400
<.002%>
-320 LN2
4-4-5
2WN31-2

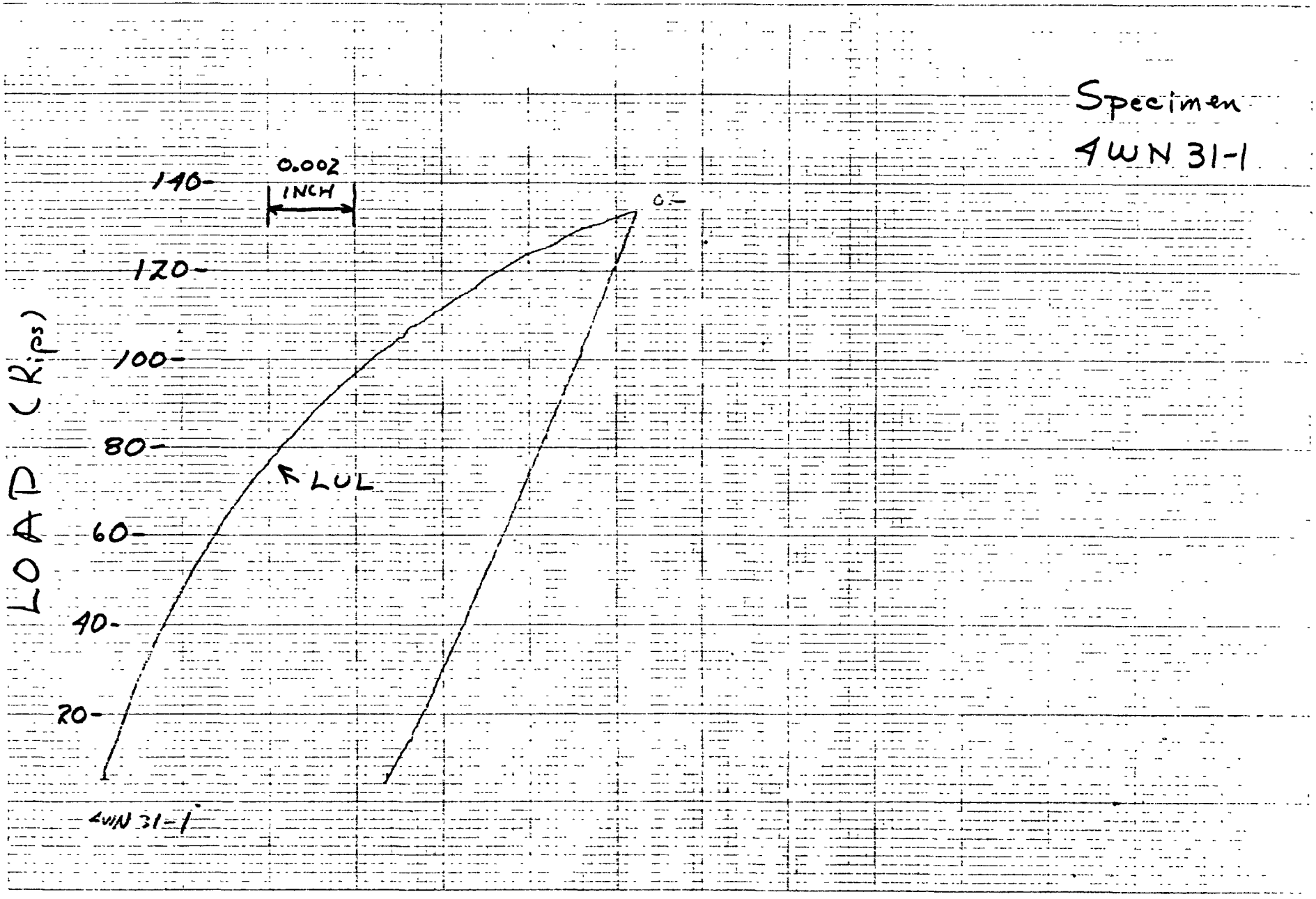

Specimen
2WN31-3
0.002
INCH
150
120
90
60
30
0
LOAD (Kips)
30,000
120,154#
LUL
.002
OVERLOAD
2WN31-3
-320°F
4-7-75

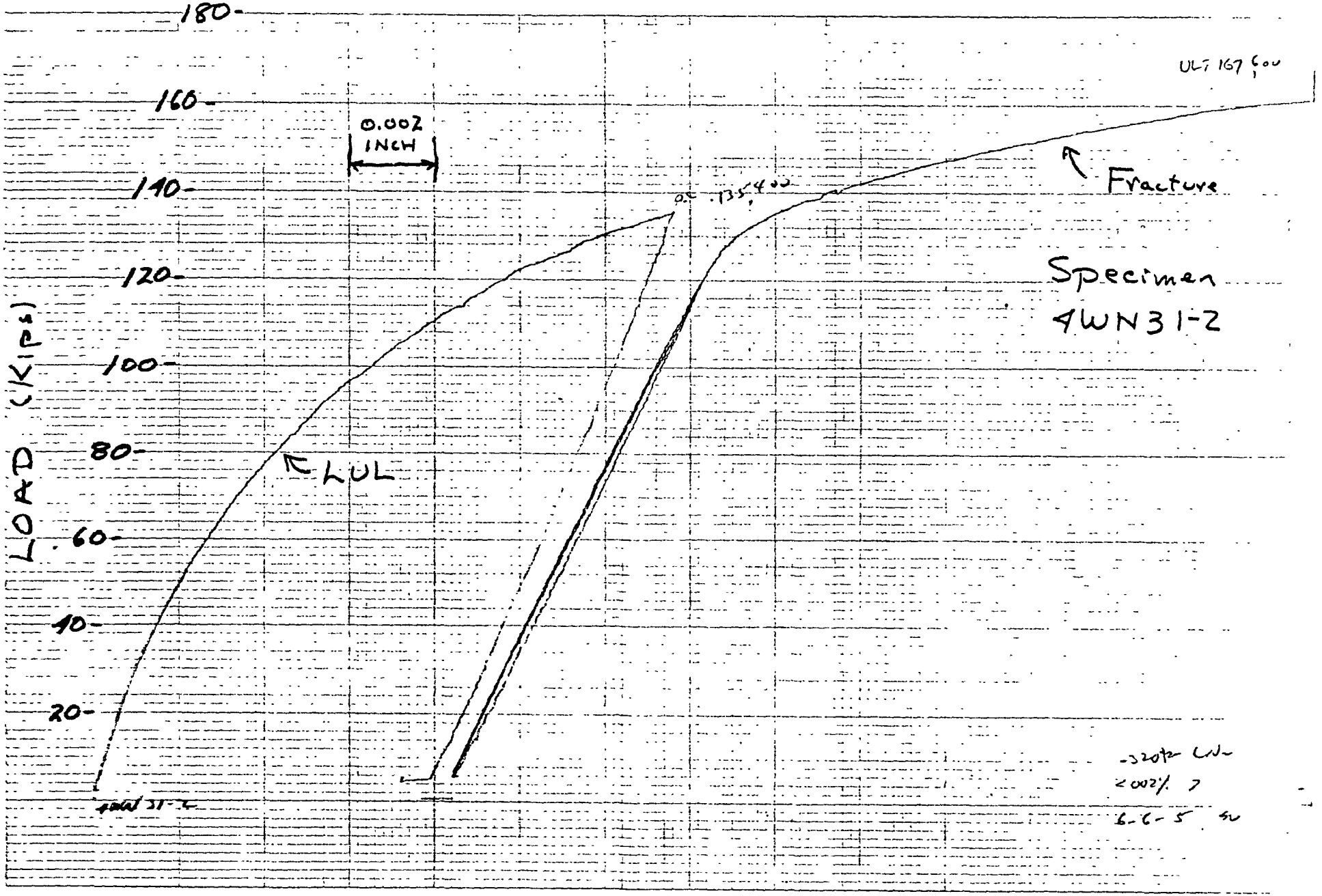

Specimen
2WN 31-3
LOAD (KIPS)
180
150
120
90
60
30
30,000
0.004 INCH
→ 004 ←
Fracture
165,000#
2WN 31-3
-320° F
STATIC FAILURE
4-7-75

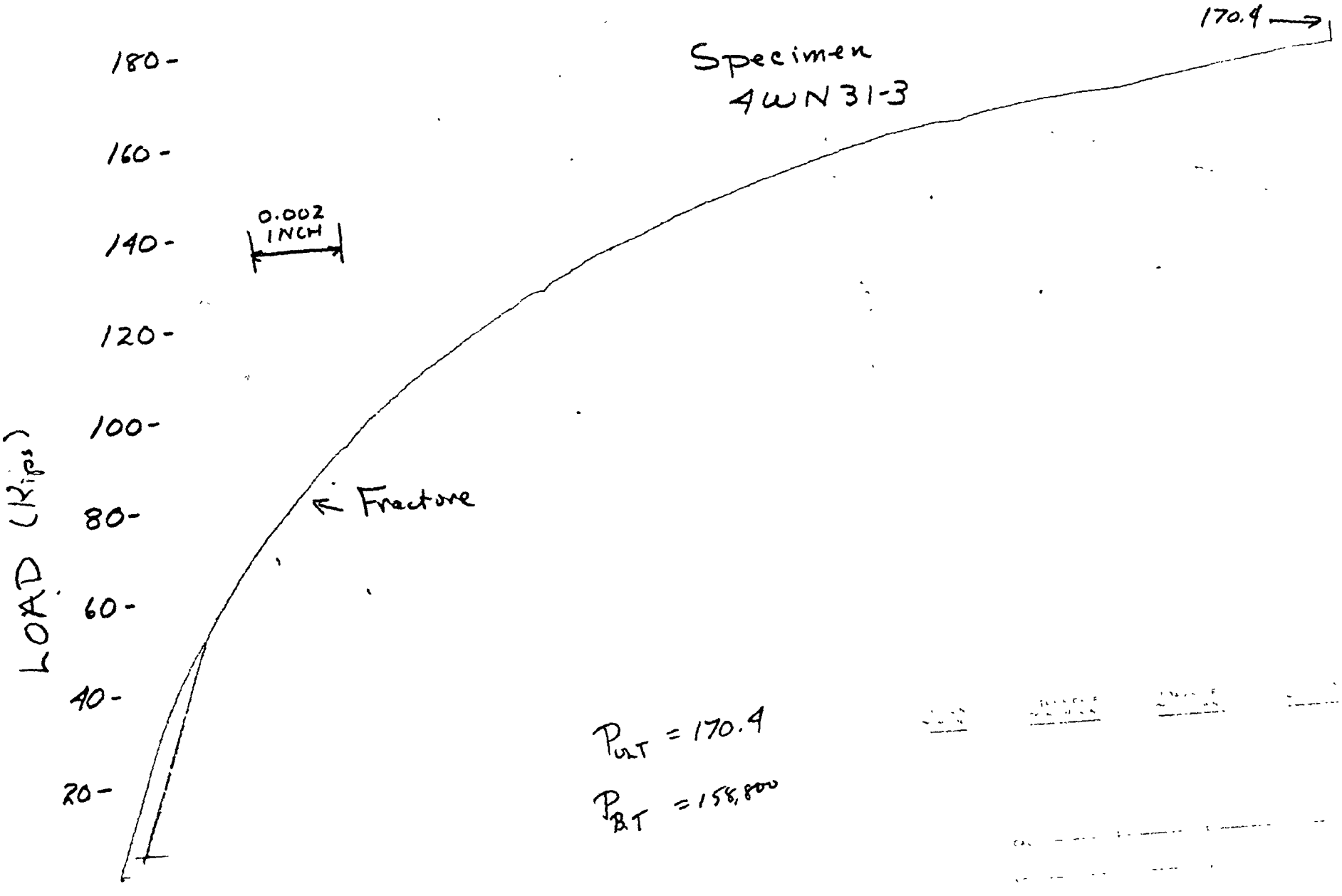

Specimen
2WN31-4
180
160
140
120
100
80
60
40
20
LOAD (KIPS)
0.002
INCH
← EDI Failed
170,200 LBS
FRACTURE
2WN31-4

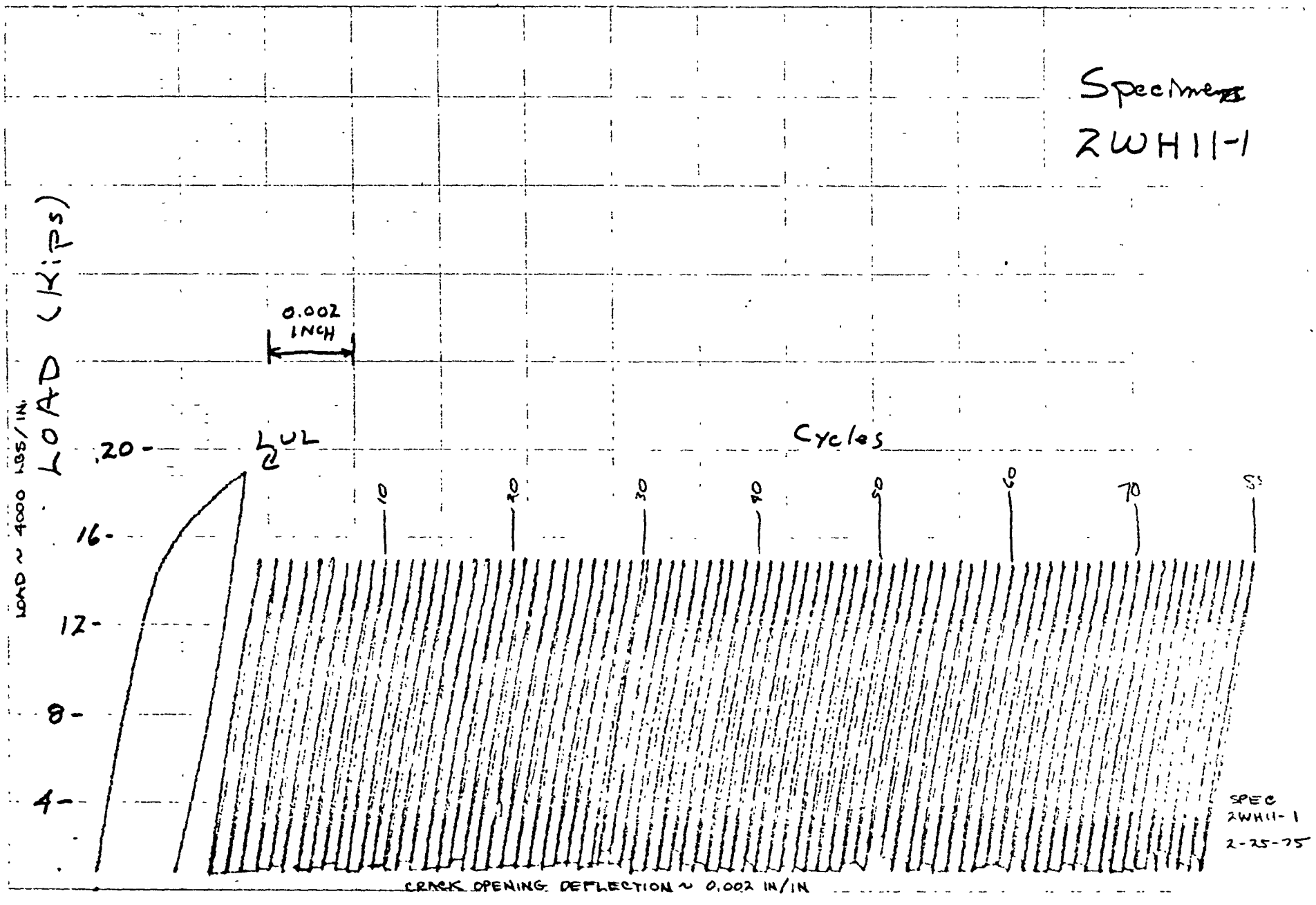

Specimen
3WN31-1
ULT 168,400
EDT Failed
0.002
INCH
LOAD (Kips)
LUL
Fracture
3WN31-1


180-
160-
140-
120-
100-
80-
60-
40-
20-
LOAD (Kips)
0.002
INCH
Specimen
3WN 31-2
ULT 166,500
OL 132,700
Fracture
LOL
3WN 31-2

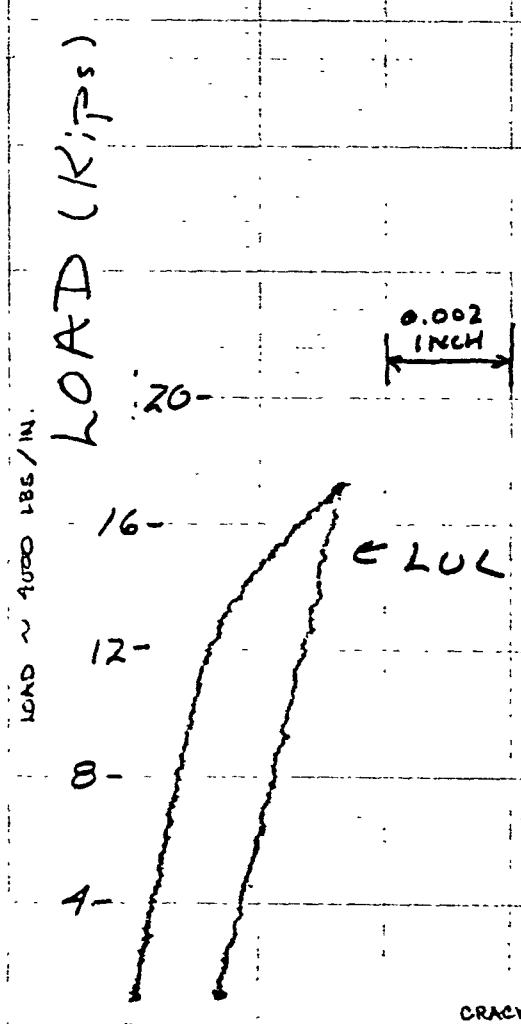

Specimen
4WN 31-1
0.002
INCH
140
120
100
80
60
40
20
LOAD (Kips)
LUL
0
4WN 31-1


180
160
140
120
100
80
60
40
20
LOAD (KIPS)
0.002 INCH
LUL
Fracture
Specimen
4WN31-2
ULT 167,600
0.2 .135,400
4WN 31-2
-320 LW-
<.002" >
6-6-5 SU

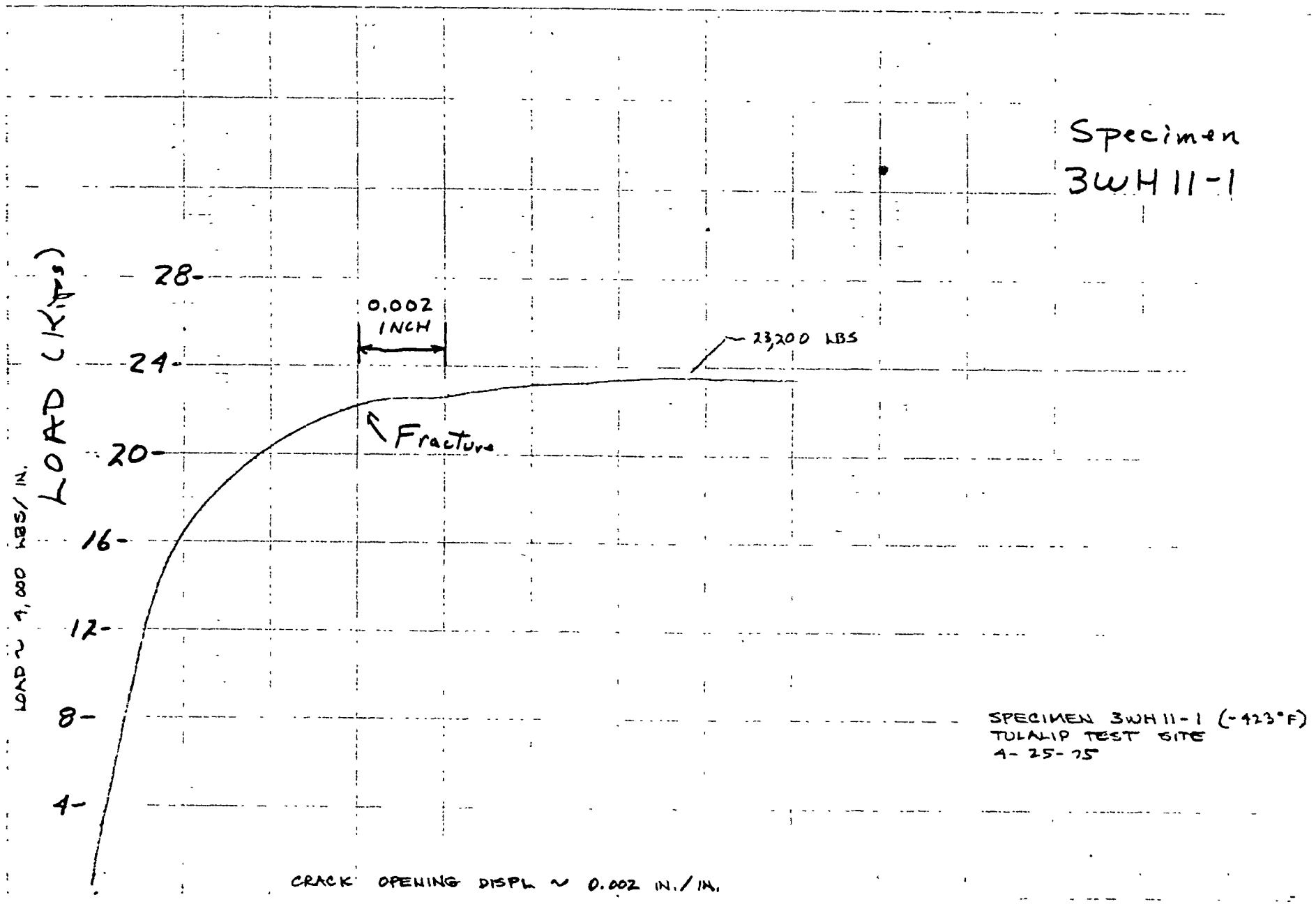

180-
160-
140-
120-
100-
80-
60-
40-
20-
LOAD (Kips)
0.002 INCH
Specimen 4WN 31-3
170.4
Fracture
P_{ULT} = 170.4
P_{BT} = 158,800
4WN 31-3 -320°F

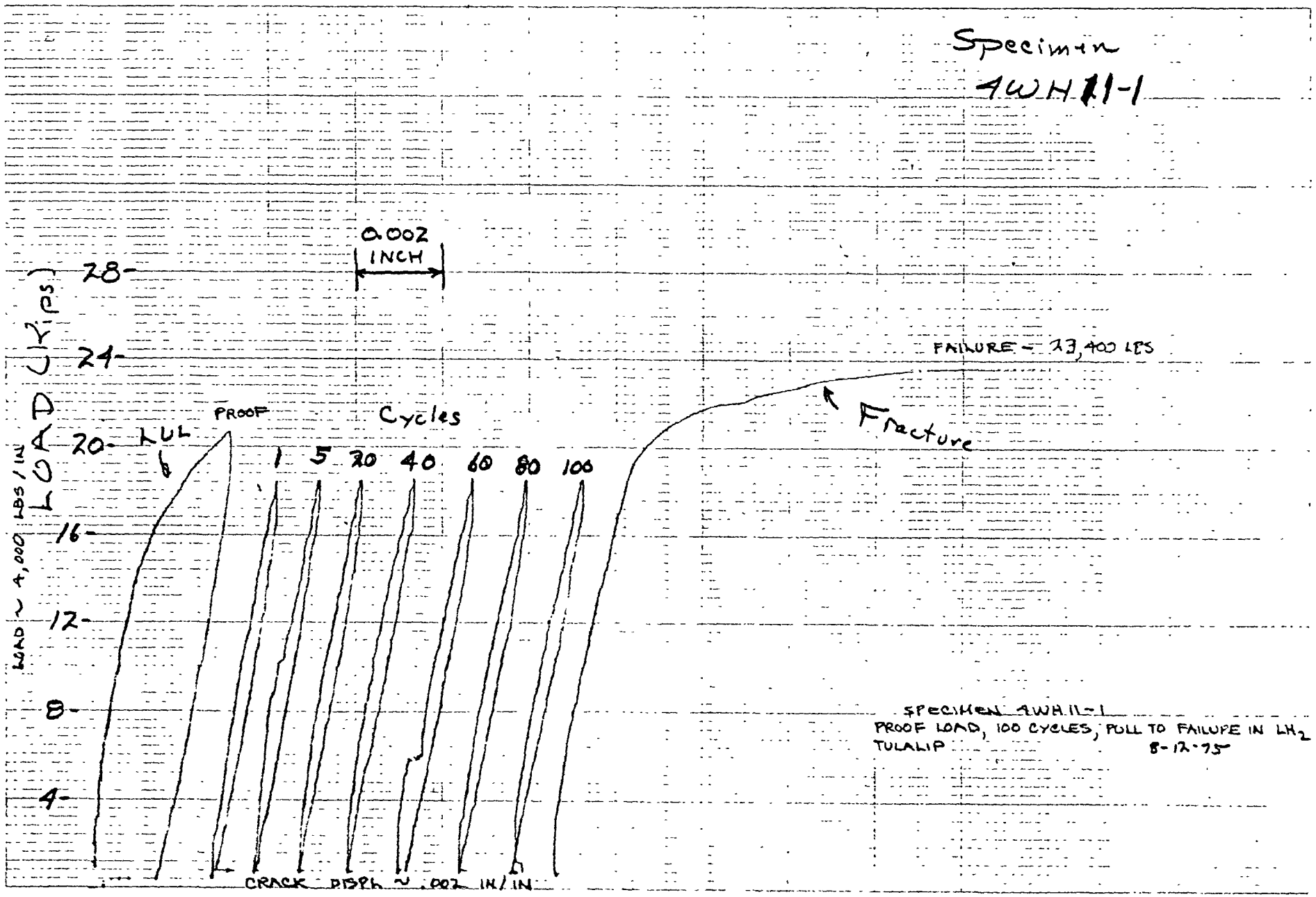

Specimen
2WH11-1
0.002
INCH
LOAD (KIPS)
LOAD ~ 4000 LBS/IN.
.20
16
12
8
4
½ UL
Cycles
10
20
30
40
50
60
70
80
SPEC
2WH11-1
2-25-75
CRACK OPENING DEFLECTION ~ 0.002 IN/IN

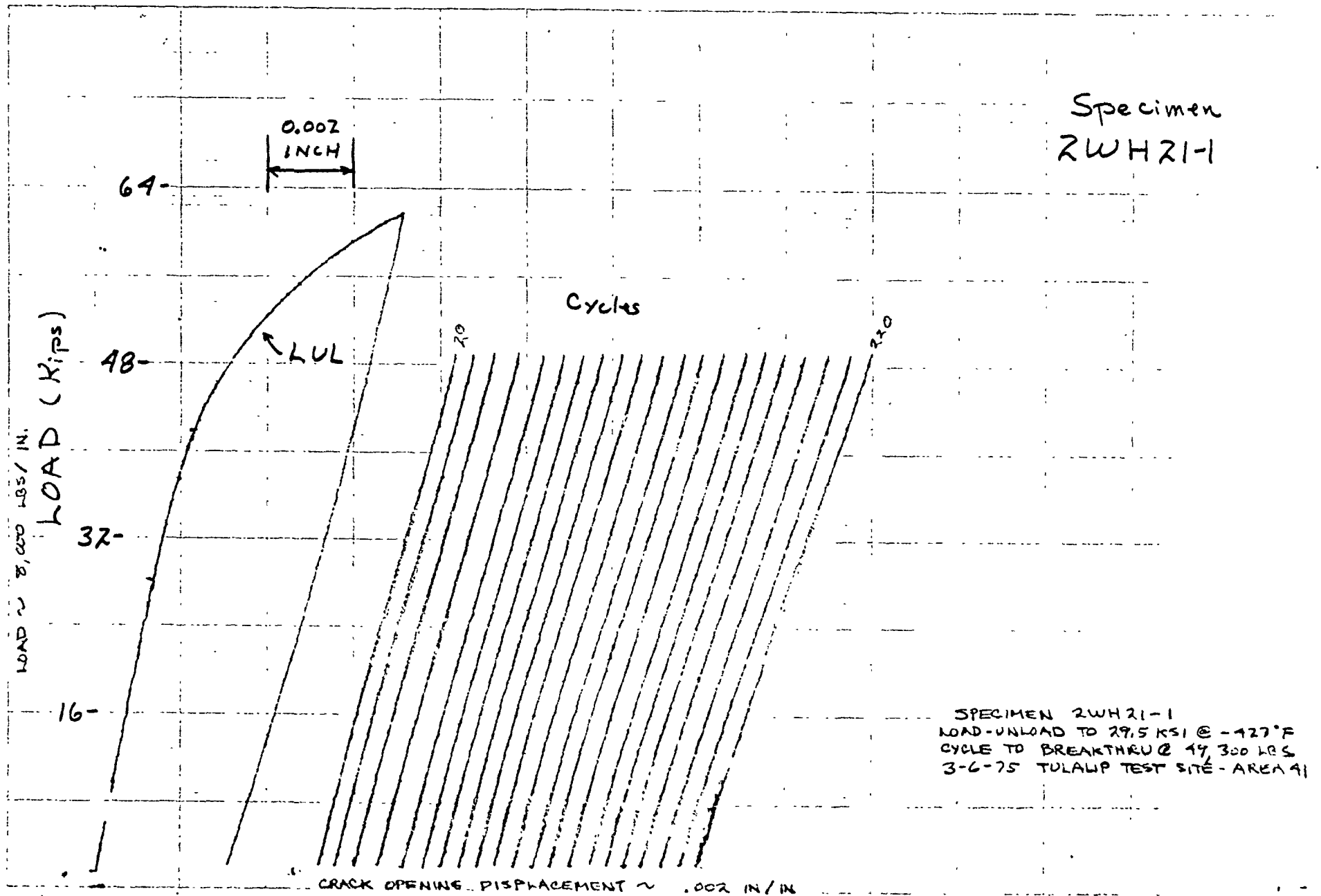
Specimen
2WH11-2

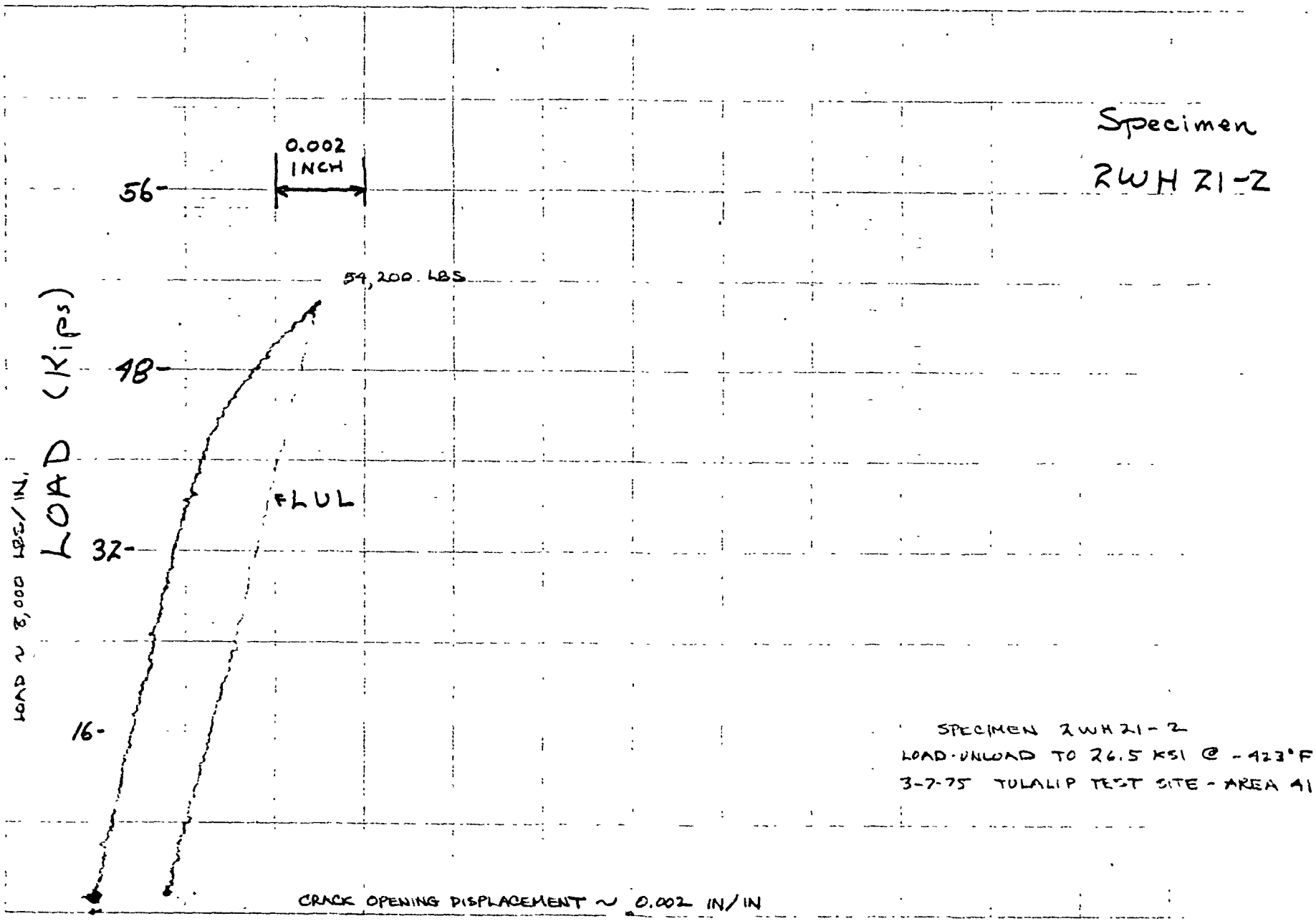


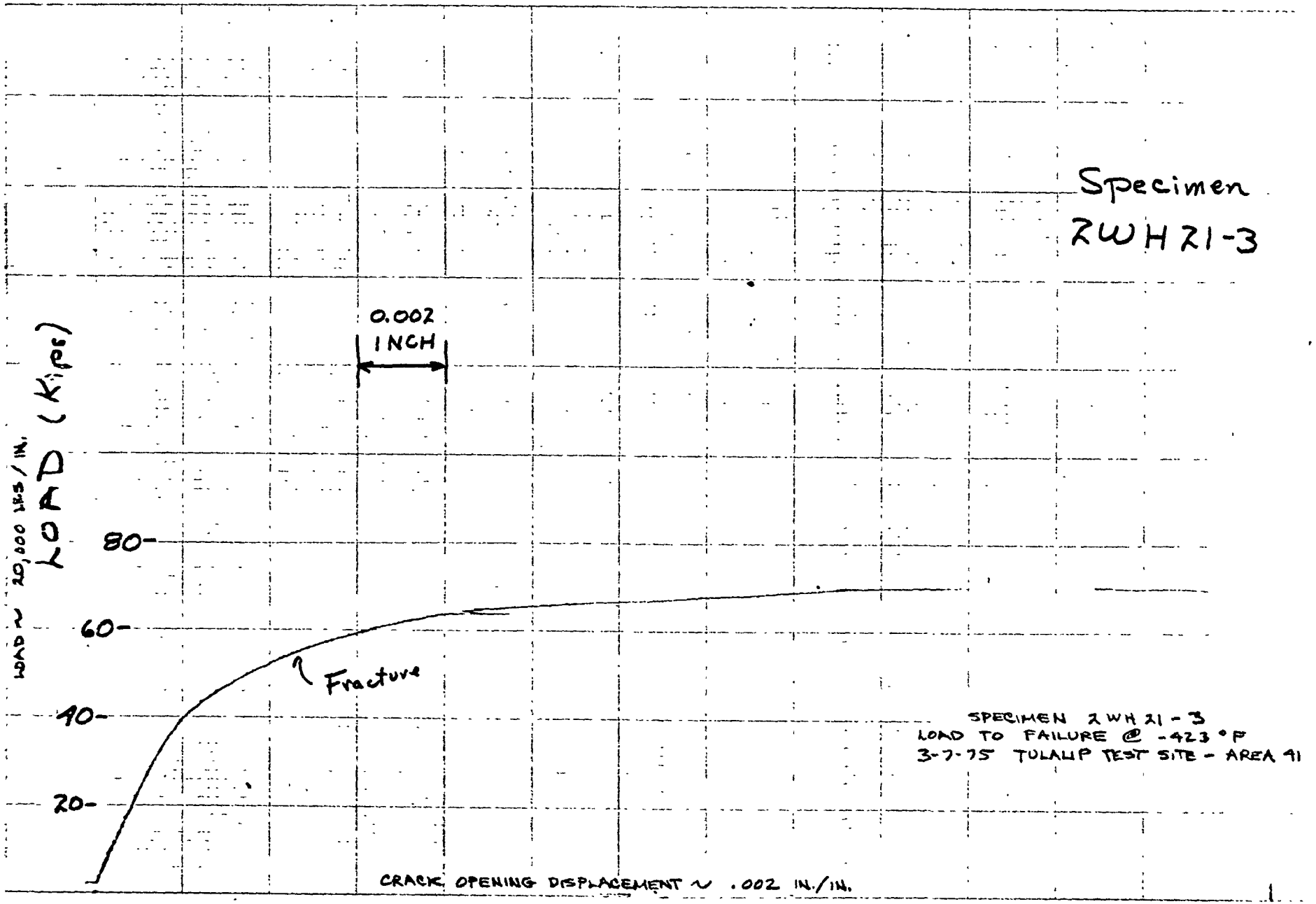
SPEC. 2WH11-2
LOAD-UNLOAD TO 26.6 KSI (17,200 LBS)
AT -923°F
3-4-75 TOLALIP TEST SITE - AREA 41

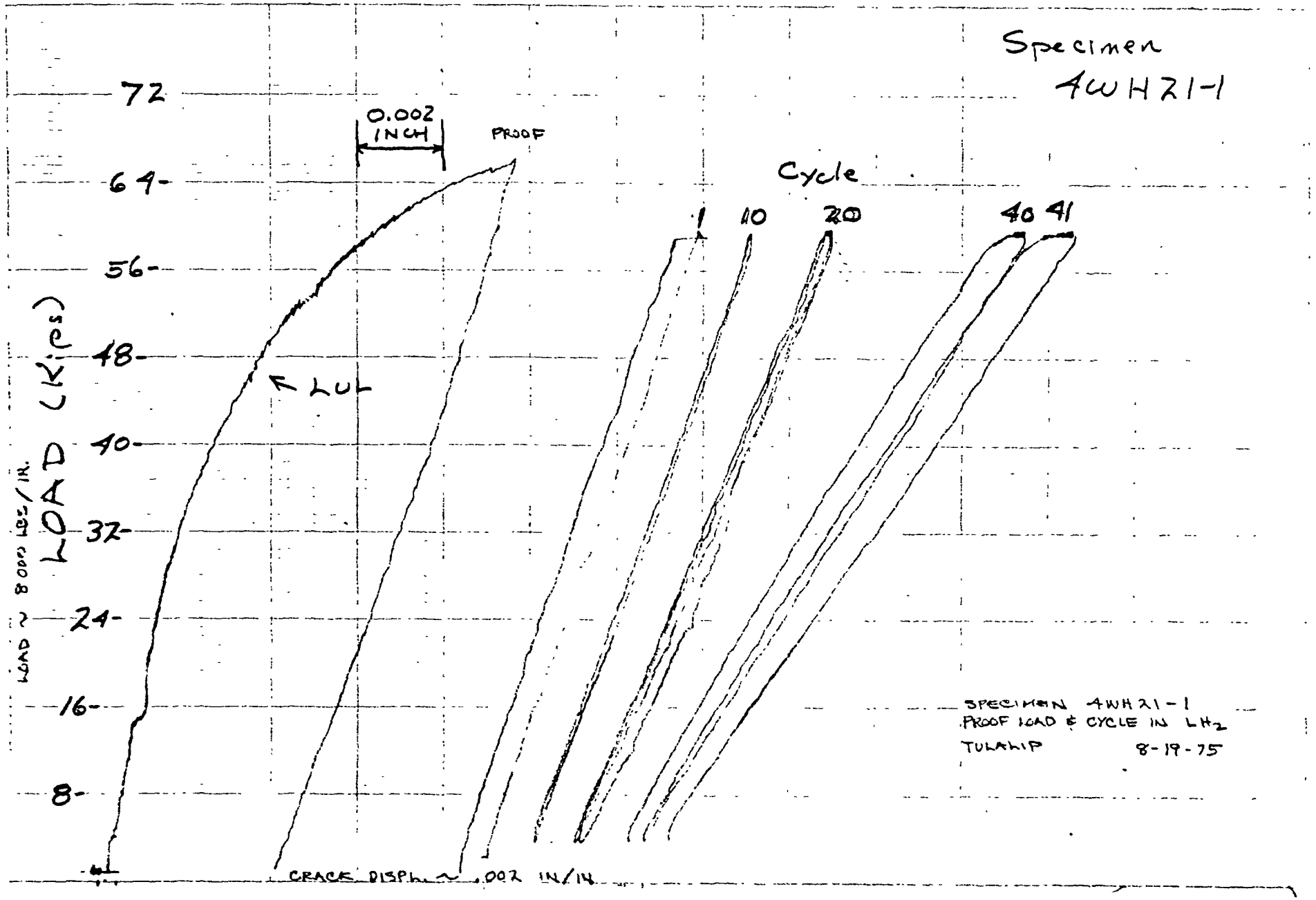

Specimen
3WH11-1
LOAD (KIPS)
28
24
20
16
12
8
4
0.002
INCH
~ 23,200 LBS
Fracture
LOAD ~ 1,000 LBS/IN.
SPECIMEN 3WH11-1 (-423°F)
TULALIP TEST SITE
4-25-75
CRACK OPENING DISPL ~ 0.002 IN./IN.

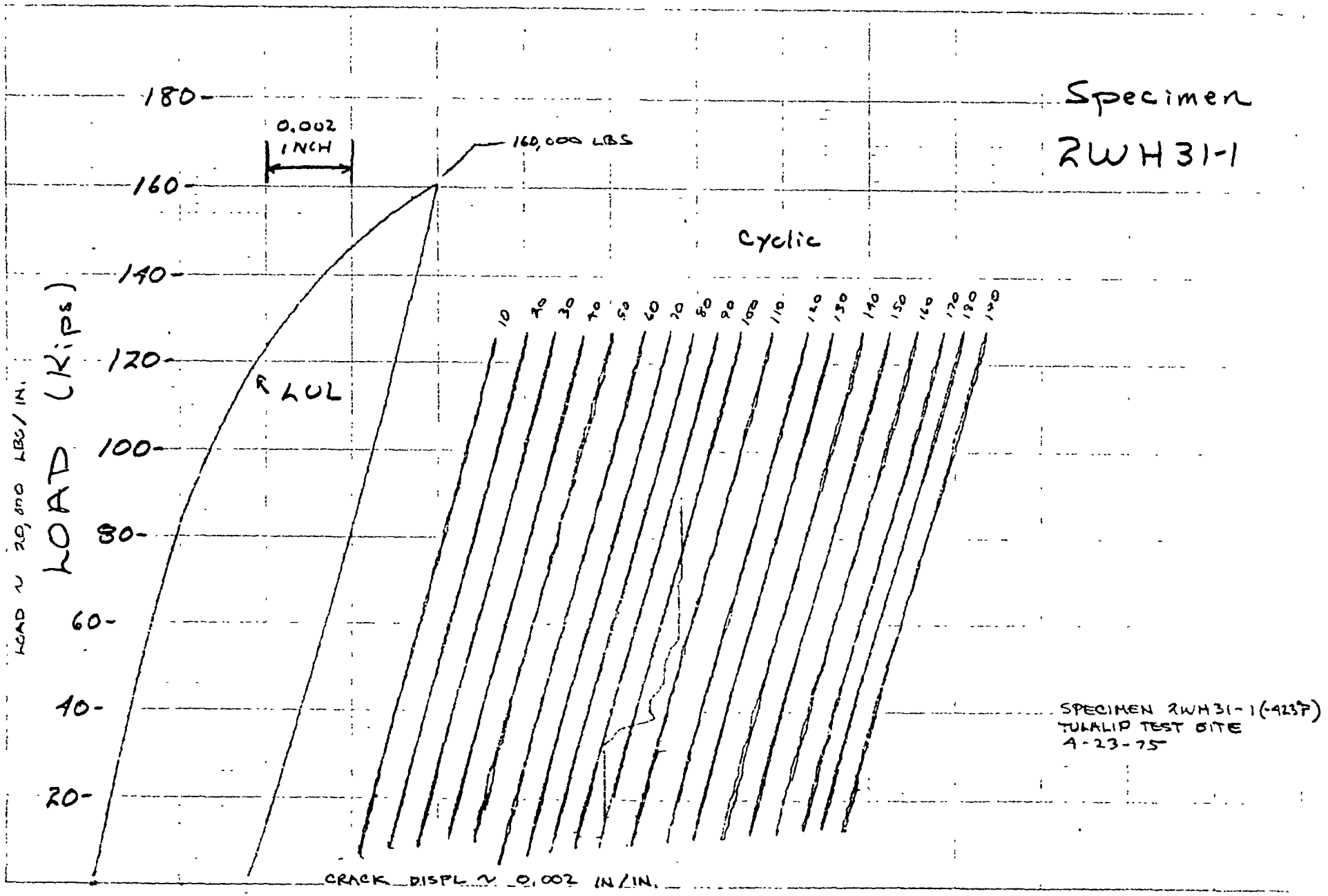

Specimen
9WH11-1
0.002 INCH
LOAD (KIPS)
28
24
20
16
12
8
4
LOAD ~ 4,000 LBS / IN
PROOF
LUL
Cycles
1 5 20 40 60 80 100
FAILURE = 23,400 LBS
Fracture
CRACK DISPL ~ .002 IN/IN
SPECIMEN 9WH11-1
PROOF LOAD, 100 CYCLES, PULL TO FAILURE IN LH2
TULALIP
8-12-75


Specimen
2WH21-1
0.002
INCH
64-
48-
32-
16-
LOAD (Kips)
LOAD ~ 8,000 LBS/IN.
LUL
Cycles
20
220
CRACK OPENING DISPLACEMENT ~ .002 IN/IN
SPECIMEN 2WH21-1
LOAD-UNLOAD TO 29.5 KSI @ -427°F
CYCLE TO BREAKTHRU @ 49,300 LBS
3-6-75 TULALIP TEST SITE - AREA 41

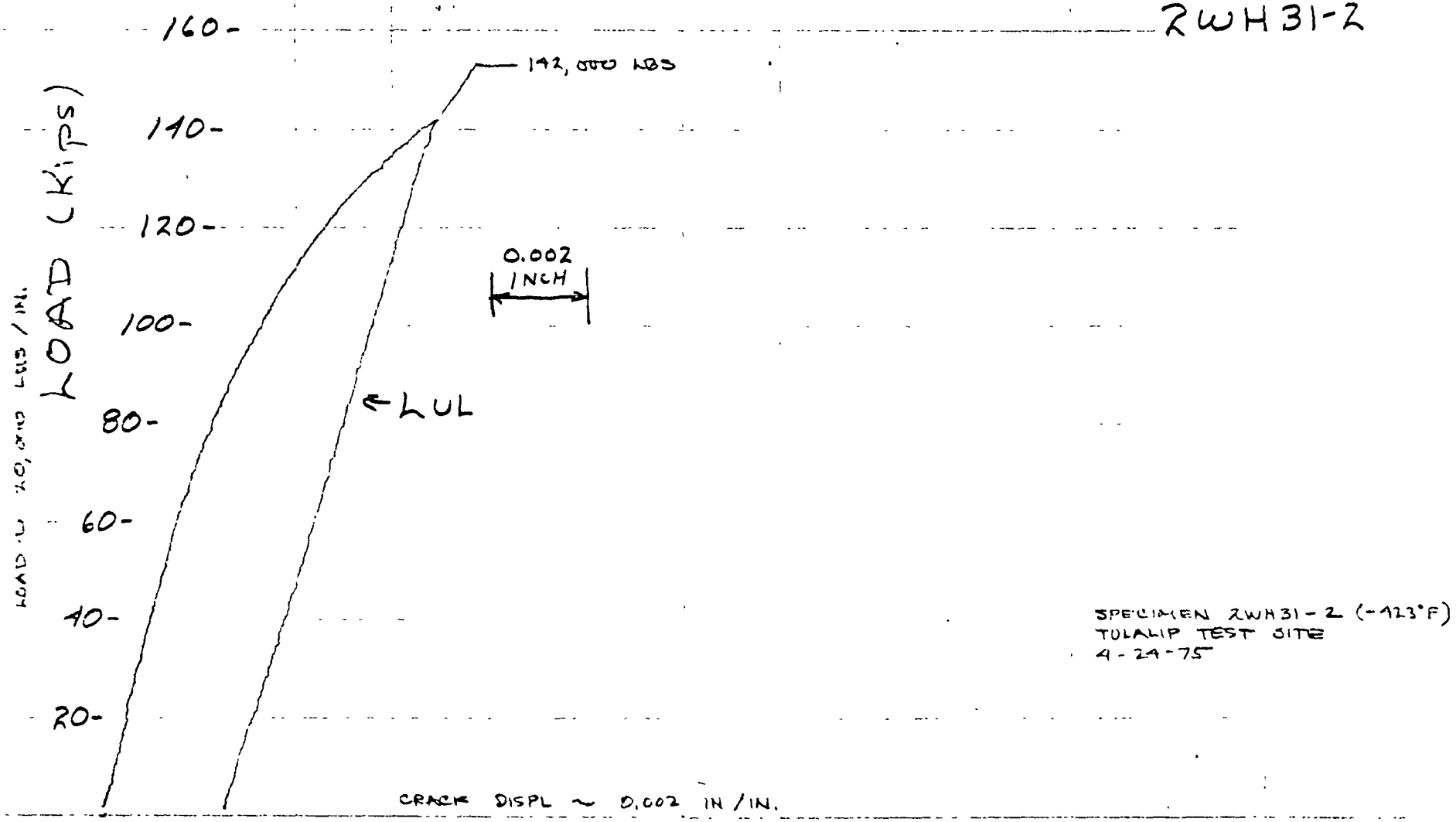

Specimen
2WH 21-2
0.002
INCH
56
48
32
16
59,200 LBS
FLUL
LOAD (Kips)
LOAD ~ 3,000 LBS/IN.
CRACK OPENING DISPLACEMENT ~ 0.002 IN/IN
SPECIMEN 2WH 21-2
LOAD-UNLOAD TO 26.5 KSI @ -423°F
3-7-75 TULALIP TEST SITE - AREA 41


Specimen
2WH21-3
0.002
INCH
LOAD (Kips)
LOAD ~ 20,000 LBS / IN.
80
60
40
20
Fracture
SPECIMEN 2WH21-3
LOAD TO FAILURE @ -423°F
3-7-75 TULALIP TEST SITE - AREA 91
CRACK OPENING DISPLACEMENT ~ .002 IN./IN.

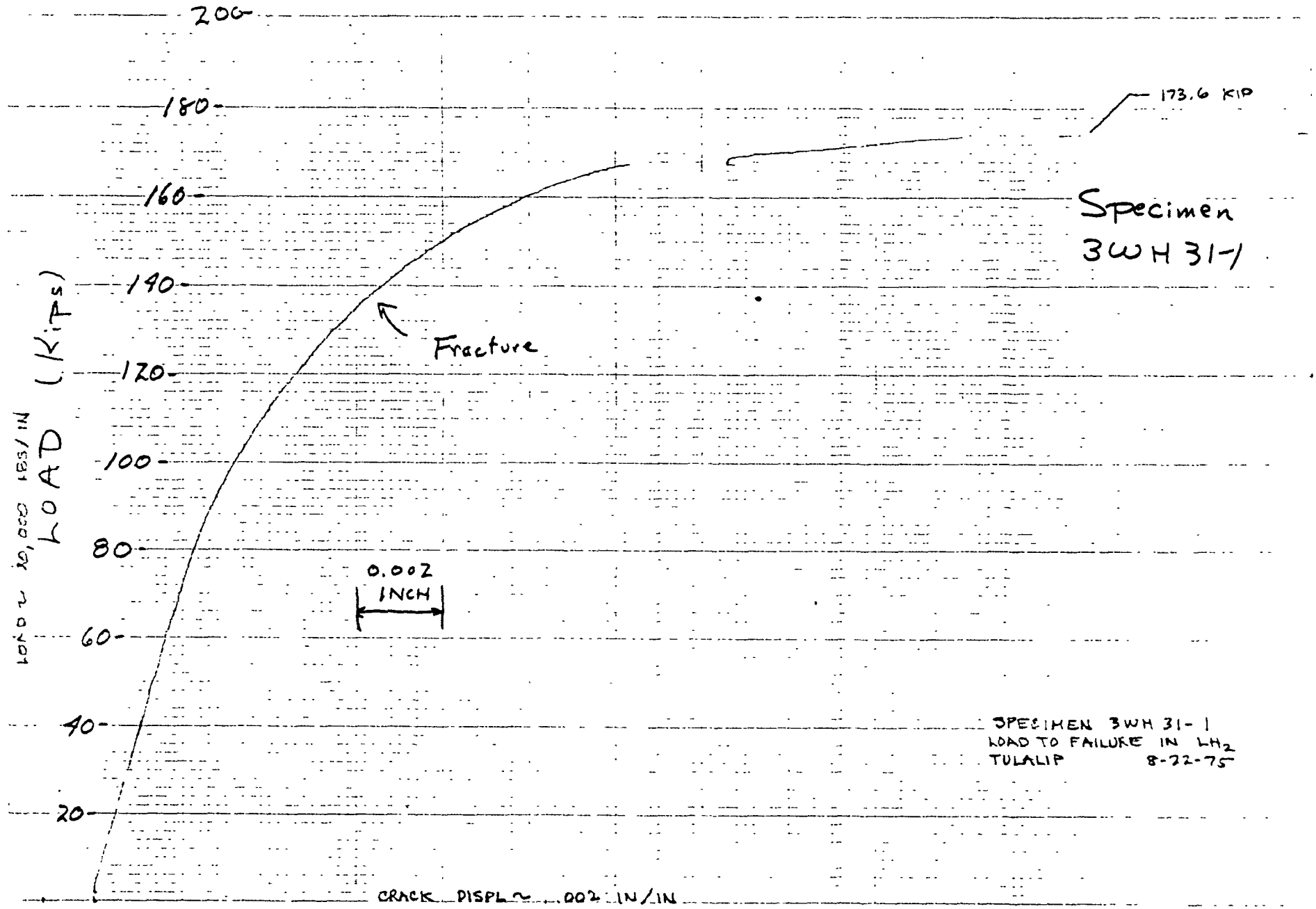

Specimen
4WH21-1
72
64
56
48
40
32
24
16
8
0.002
INCH
PROOF
Cycle
1
10
20
40
41
LOAD (Kips)
LOAD ~ 8000 LBS/IN.
LUL
CRACK DISPL ~ .002 IN/IN
SPECIMEN 4WH21-1
PROOF LOAD & CYCLE IN LH2
TULAHIP
8-19-75

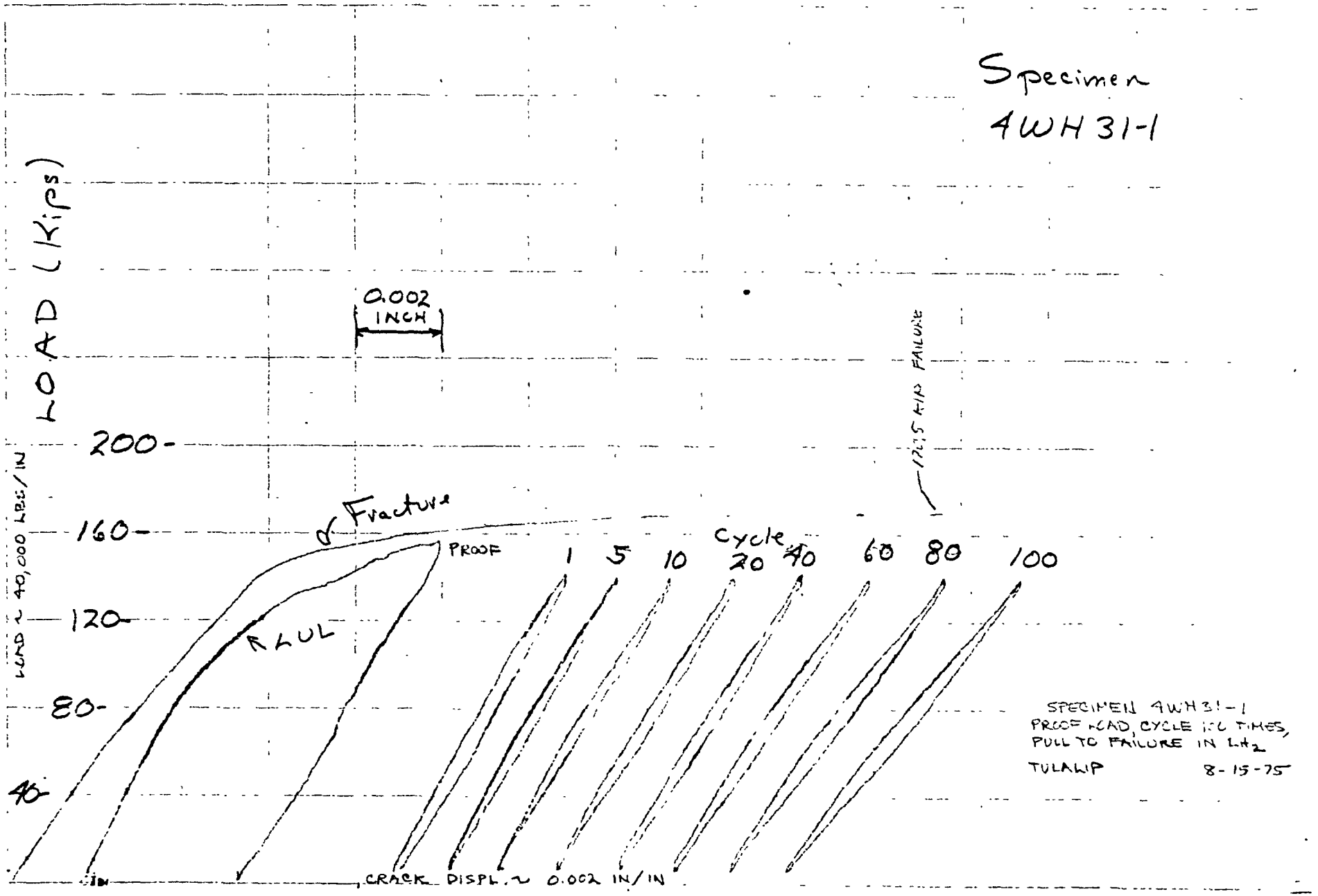

Specimen
2WH31-1
Cyclic
0.002
INCH
160,000 LBS
LUL
LOAD (Kips)
LOAD ~ 20,000 LBS/IN.
180
160
140
120
100
80
60
40
20
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
CRACK DISPL ~ 0.002 IN/IN.
SPECIMEN 2WH31-1 (-423F)
TULALIP TEST SITE
4-23-75

Specimen
2WH31-2



SPECIMEN 2WH31-2 (-423°F)
TULALIP TEST SITE
4-24-75

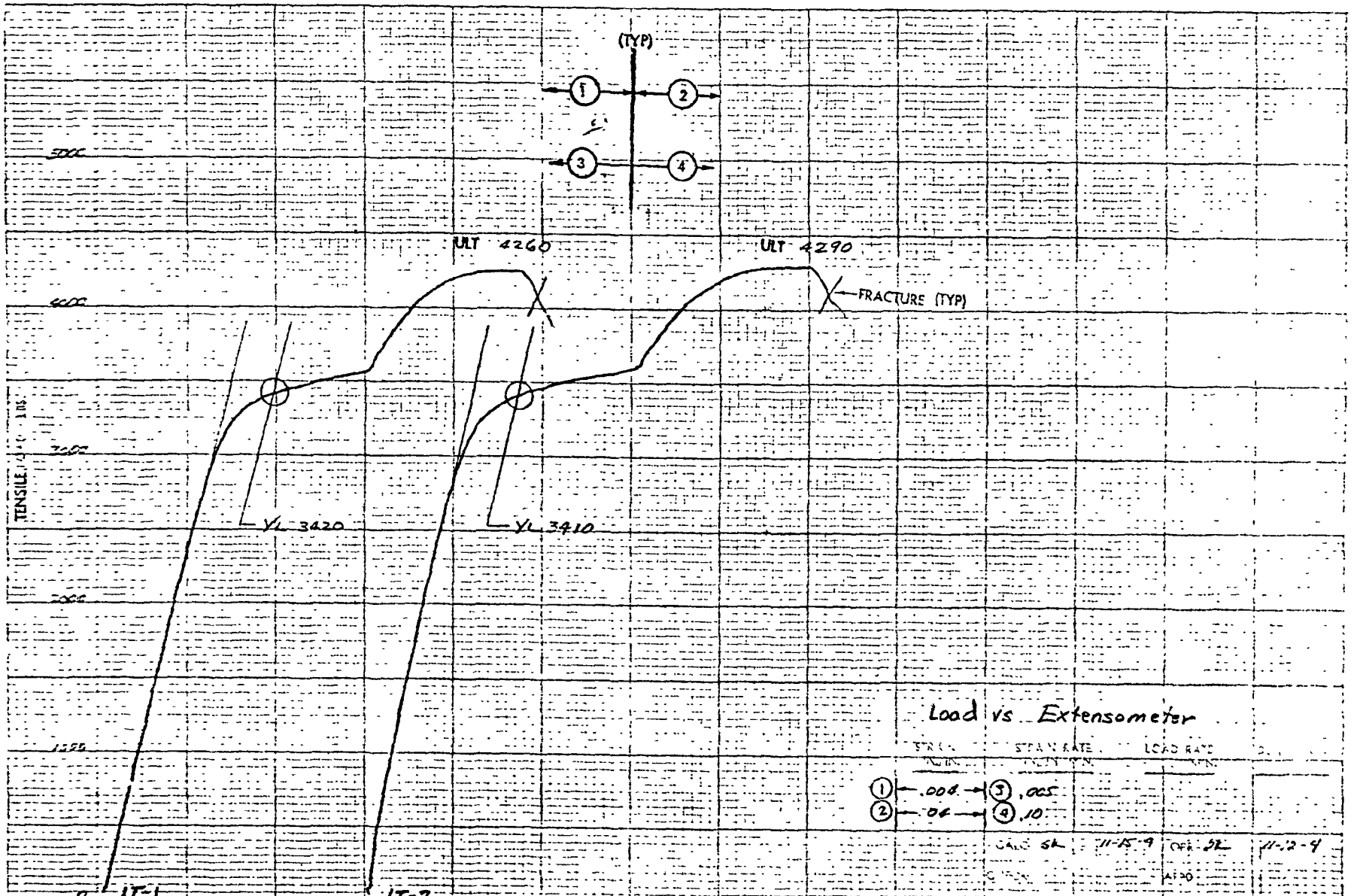

200
180
160
140
120
100
80
60
40
20
LOAD (KIPS)
LOAD x 10,000 LBS/IN
173.6 KIP
Specimen
3WH31-1
Fracture
0.002
INCH
SPECIMEN 3WH 31-1
LOAD TO FAILURE IN LH2
TULALIP 8-22-75
CRACK DISPL ~ .002 IN/IN

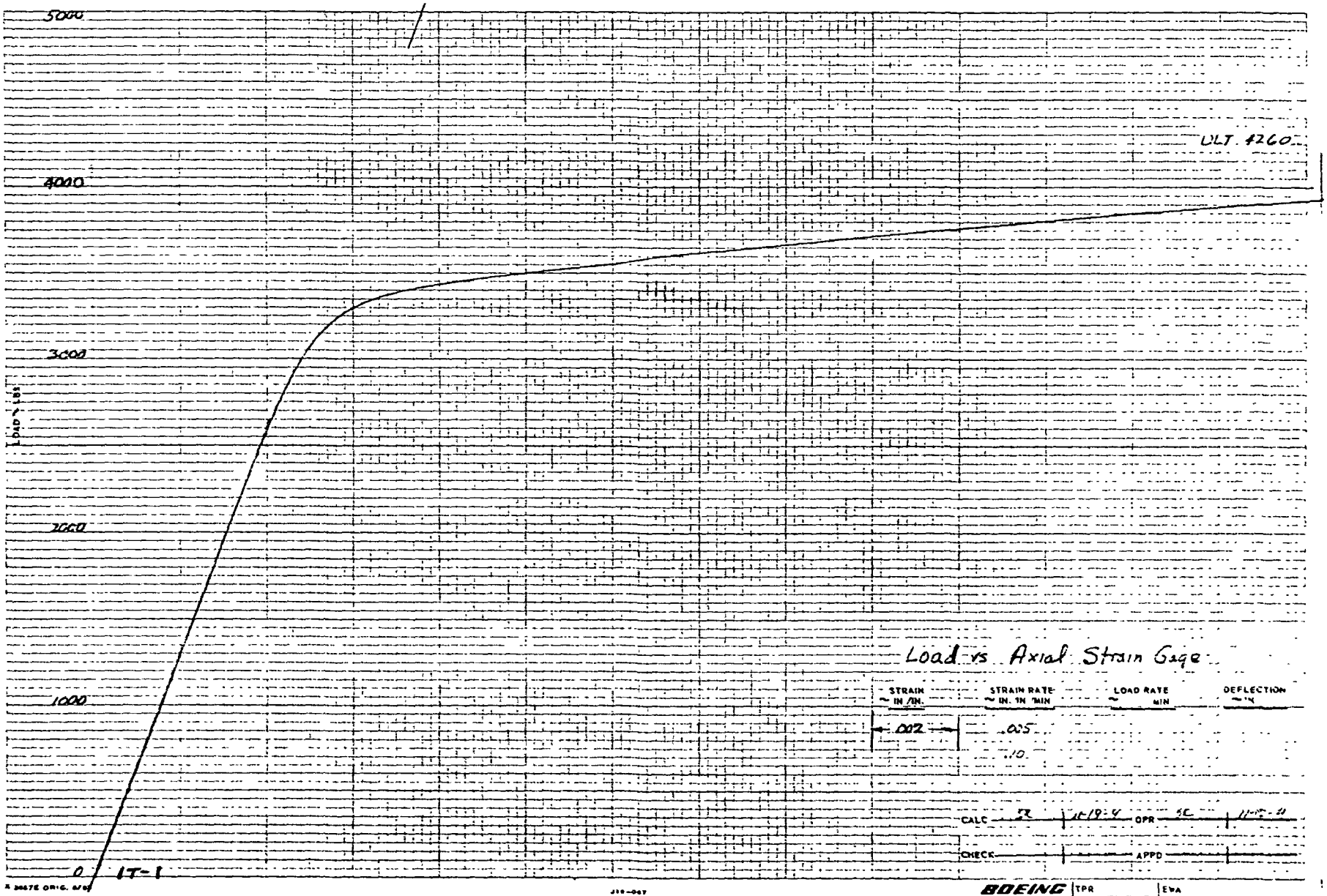

Specimen
4WH31-1
LOAD (Kips)
200
160
120
80
40
0.002 INCH
LOAD ~ 40,000 LBS/IN
Fracture
PROOF
ALUL
125 KIP FAILURE
Cycle
1
5
10
20
40
60
80
100
CRACK DISPL. ~ 0.002 IN/IN
SPECIMEN 4WH31-1
PROOF LOAD, CYCLE 100 TIMES,
PULL TO FAILURE IN LH2
TULALIP
8-15-75

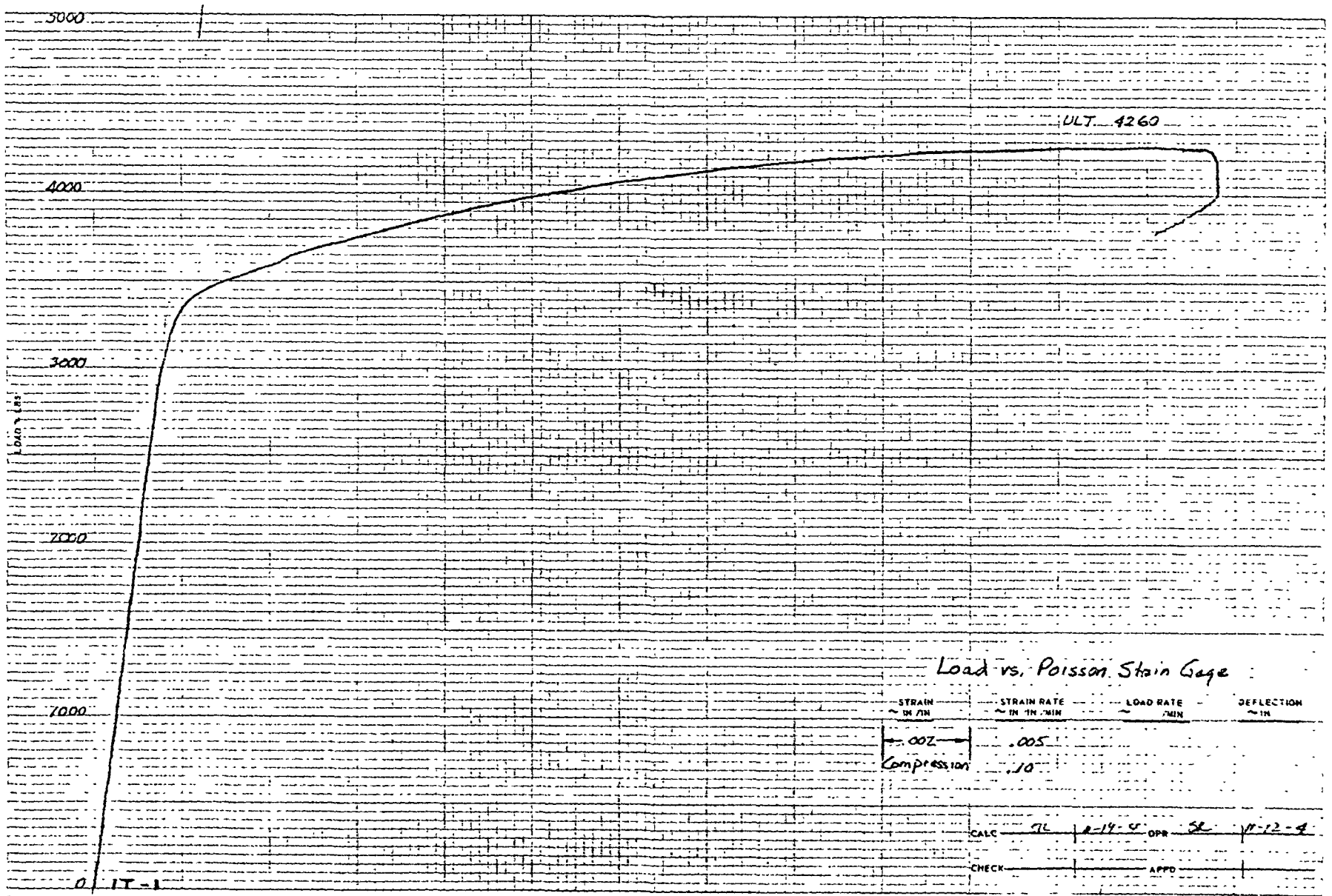
APPENDIX III - Extensometer and Strain Gage Records

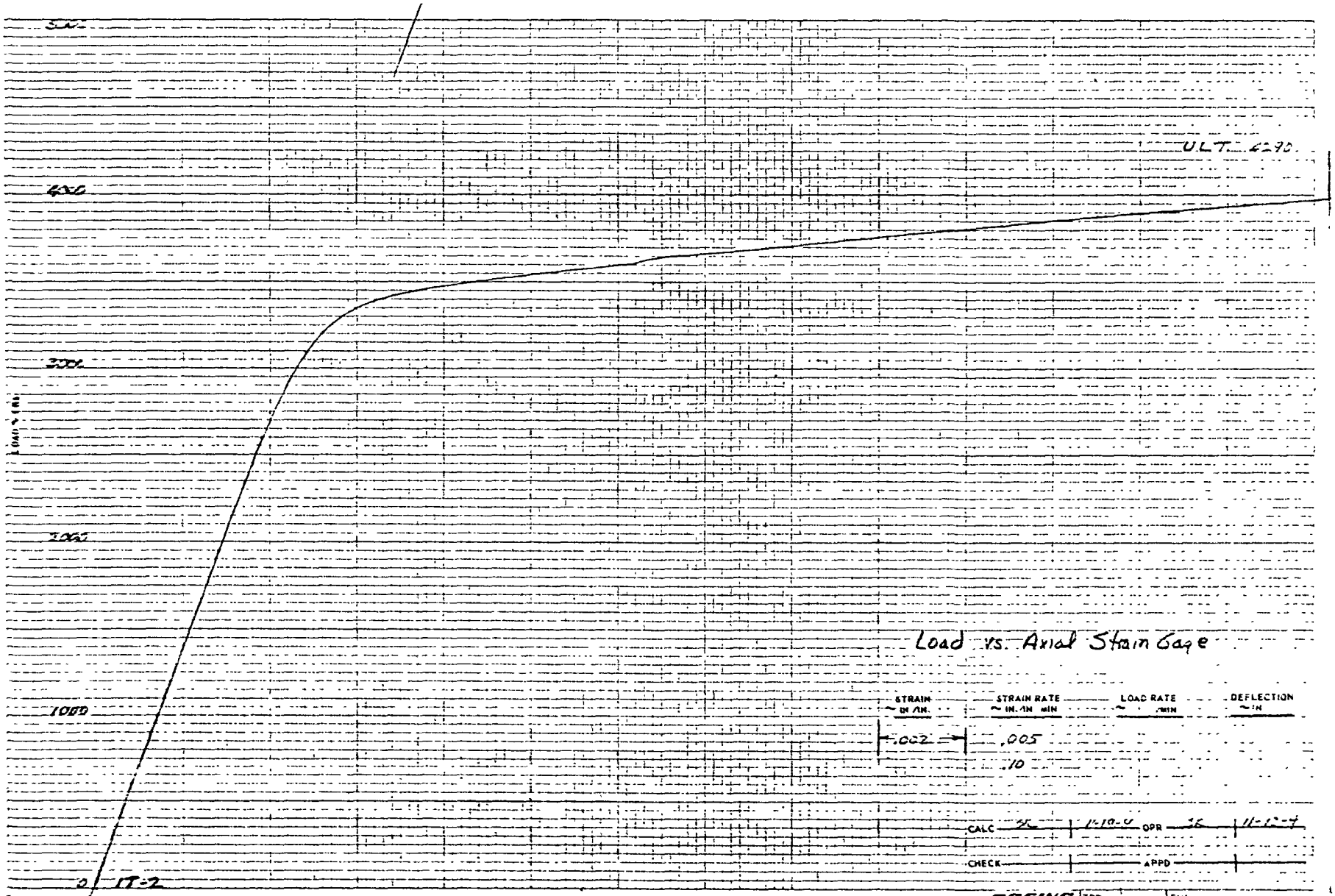
	Page
Extensometer and Strain Gage Records From Table 2 of Volume I. CR-135036.	254-291
Extensometer and Strain Gage Records From Table 3 of Volume I CR-135036.	292-323
Extensometer and Strain Gage Records From Table 4 of Volume I. CR-135036.	324-377

For machine only

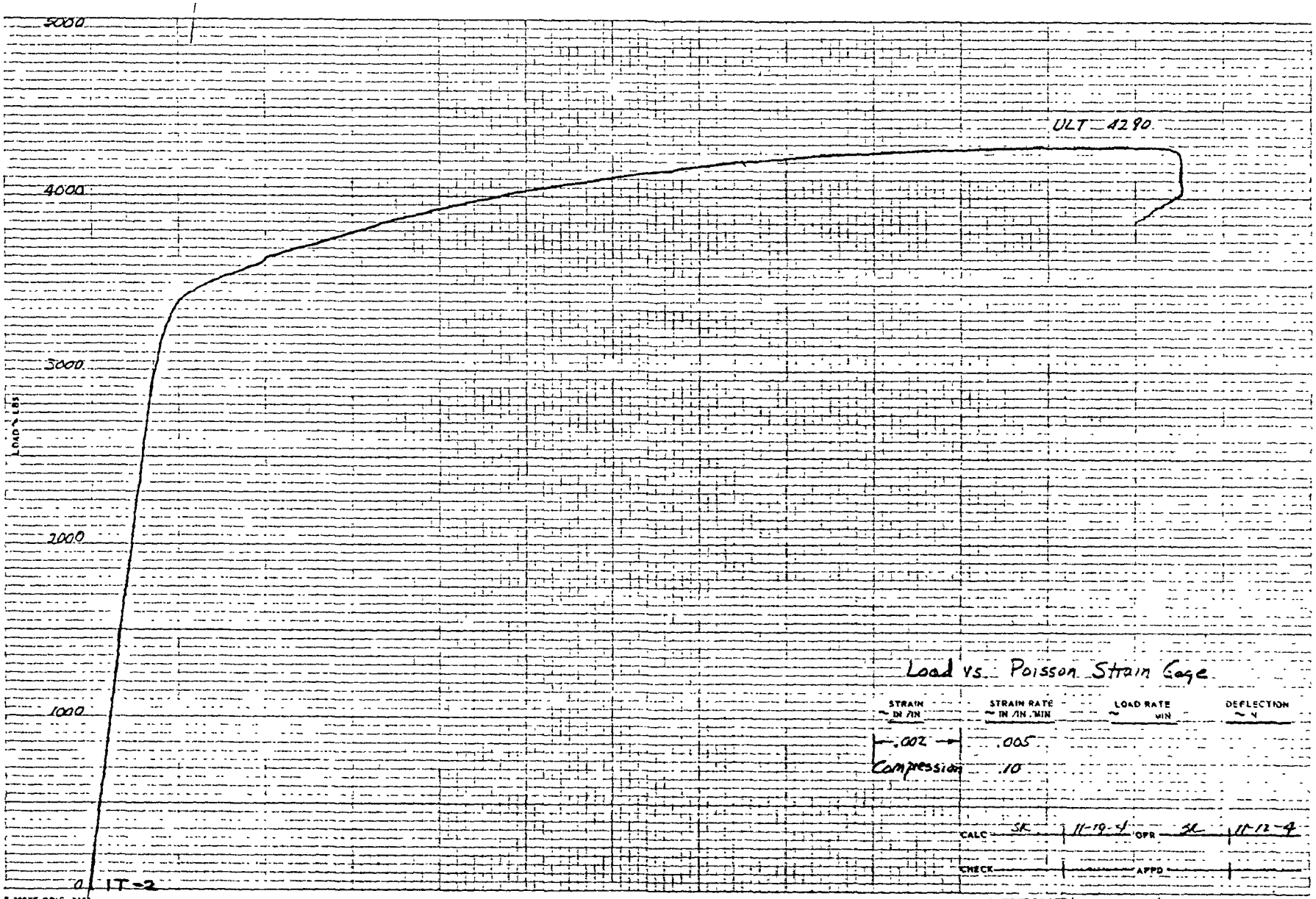



5000
4000
3000
2000
1000
0
LOAD - LBS
ULT. 4260
1T-1
Load vs Axial Strain Gage
STRAIN IN/IN.
STRAIN RATE IN. IN. MIN
LOAD RATE MIN
DEFLECTION IN
.002
.005
.10
CALC
CHECK
OPR
APPD
BOEING
TPR
EWA
PAGE
OF

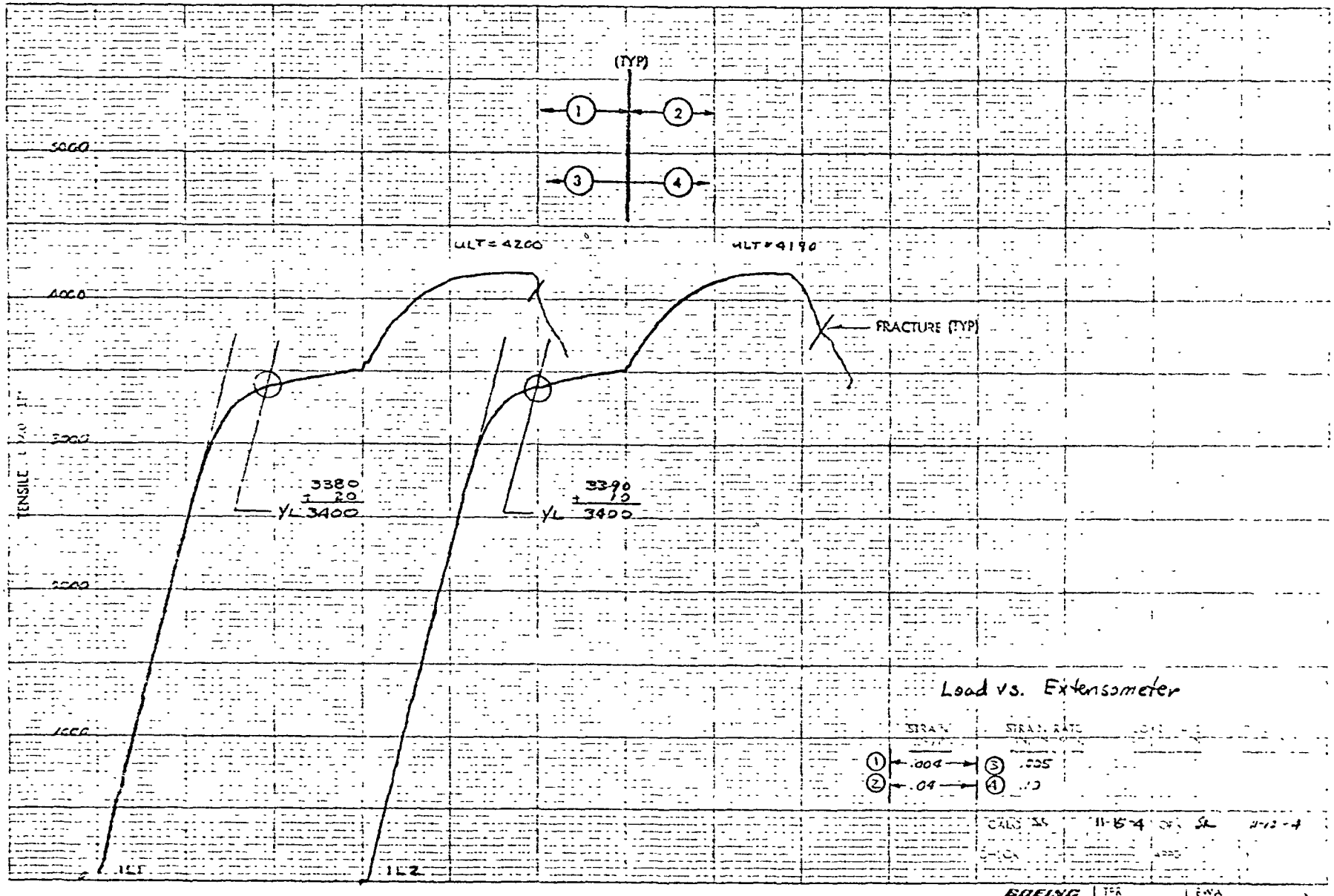

5000
4000
3000
2000
7000
0
Load, Lbs
ULT. 4260
IT-1
Load vs. Poisson Stain Gage
STRAIN ~ IN /IN
STRAIN RATE ~ IN /IN /MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
Compression
.005
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
PAGE
OF

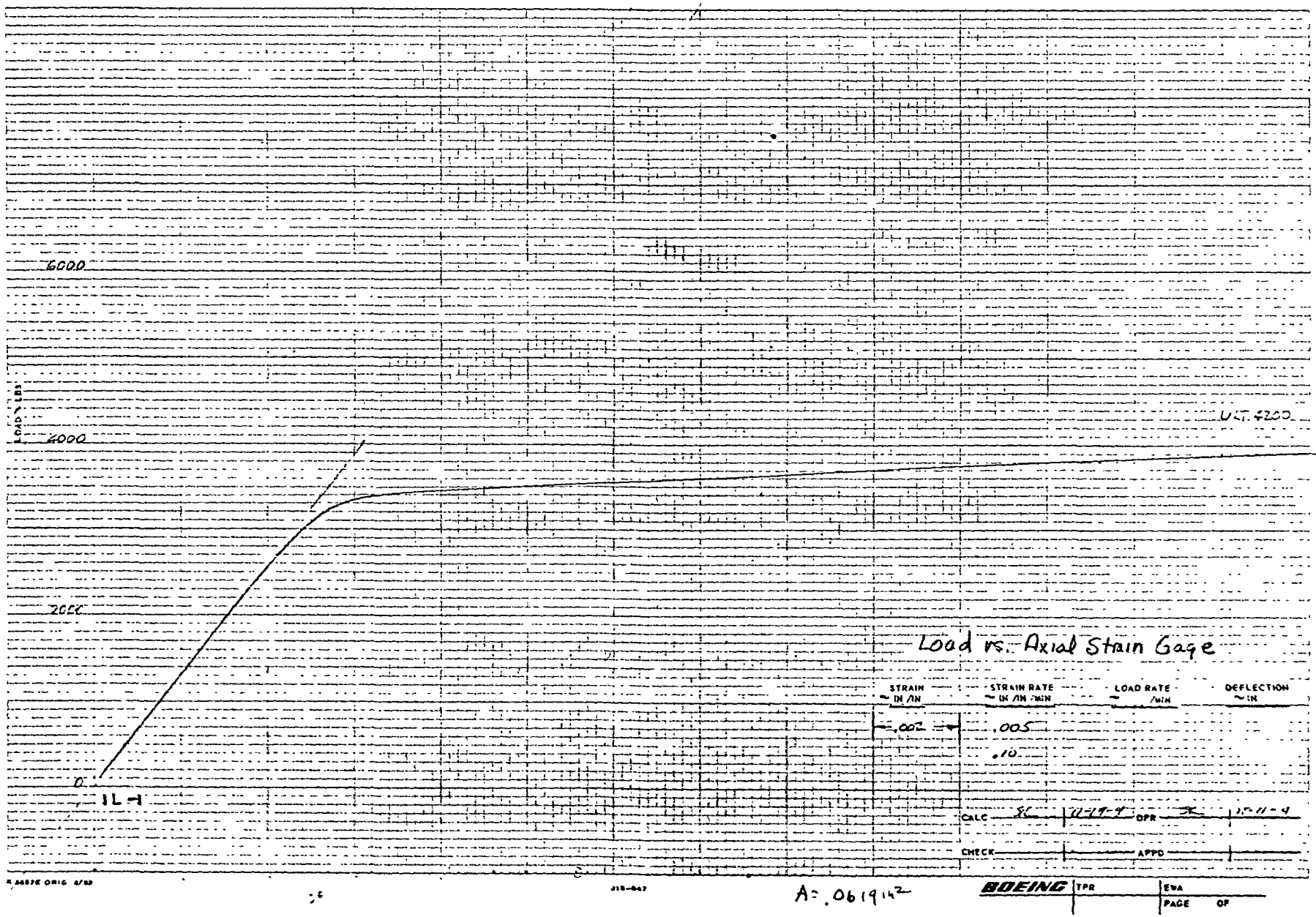

5000
4000
3000
2000
1000
0
ULT. 4290
IT-2
Load vs. Axial Strain Gage
STRAIN IN/IN.
STRAIN RATE ~ IN./IN MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
EWA
PAGE OF

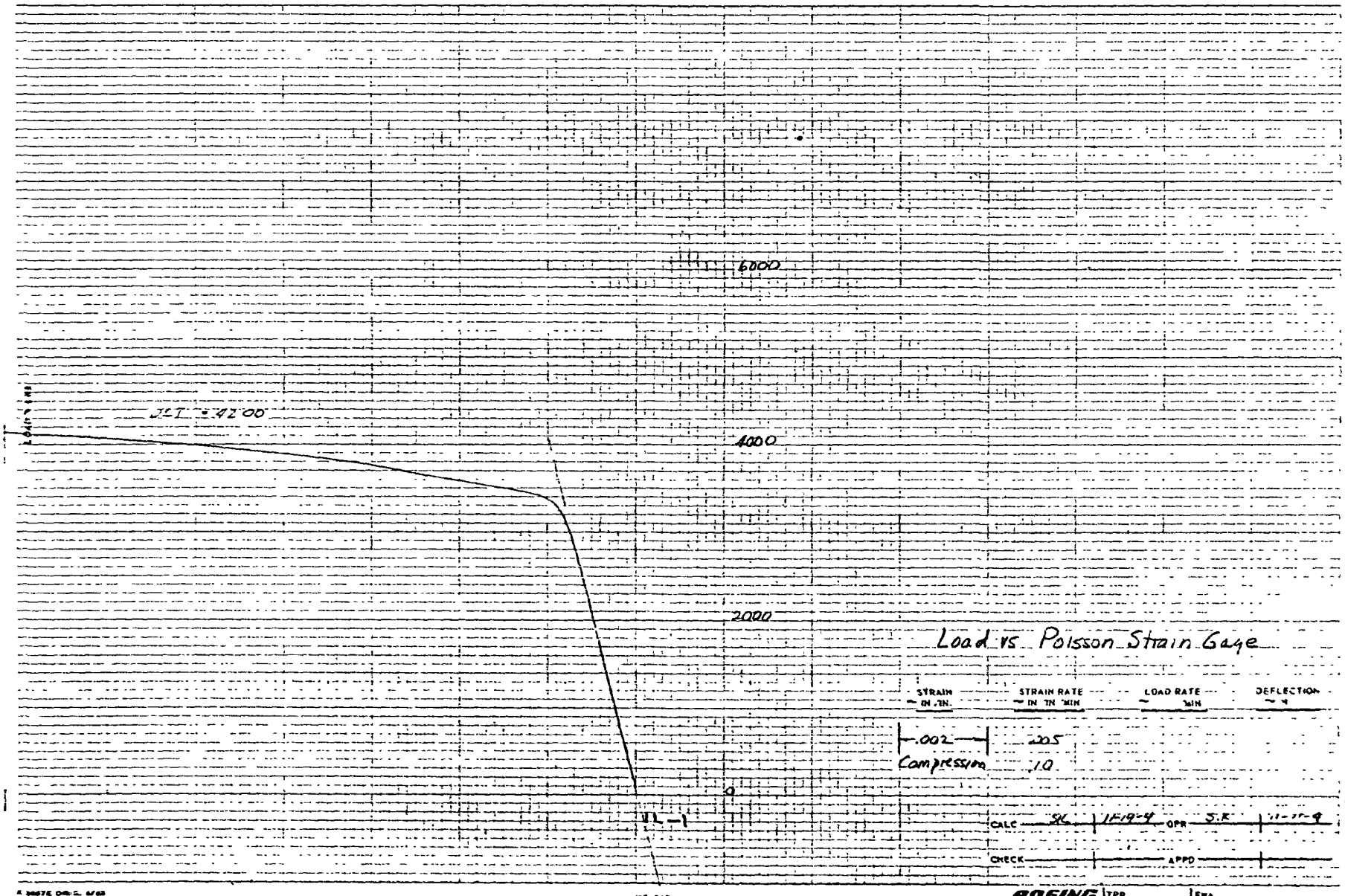
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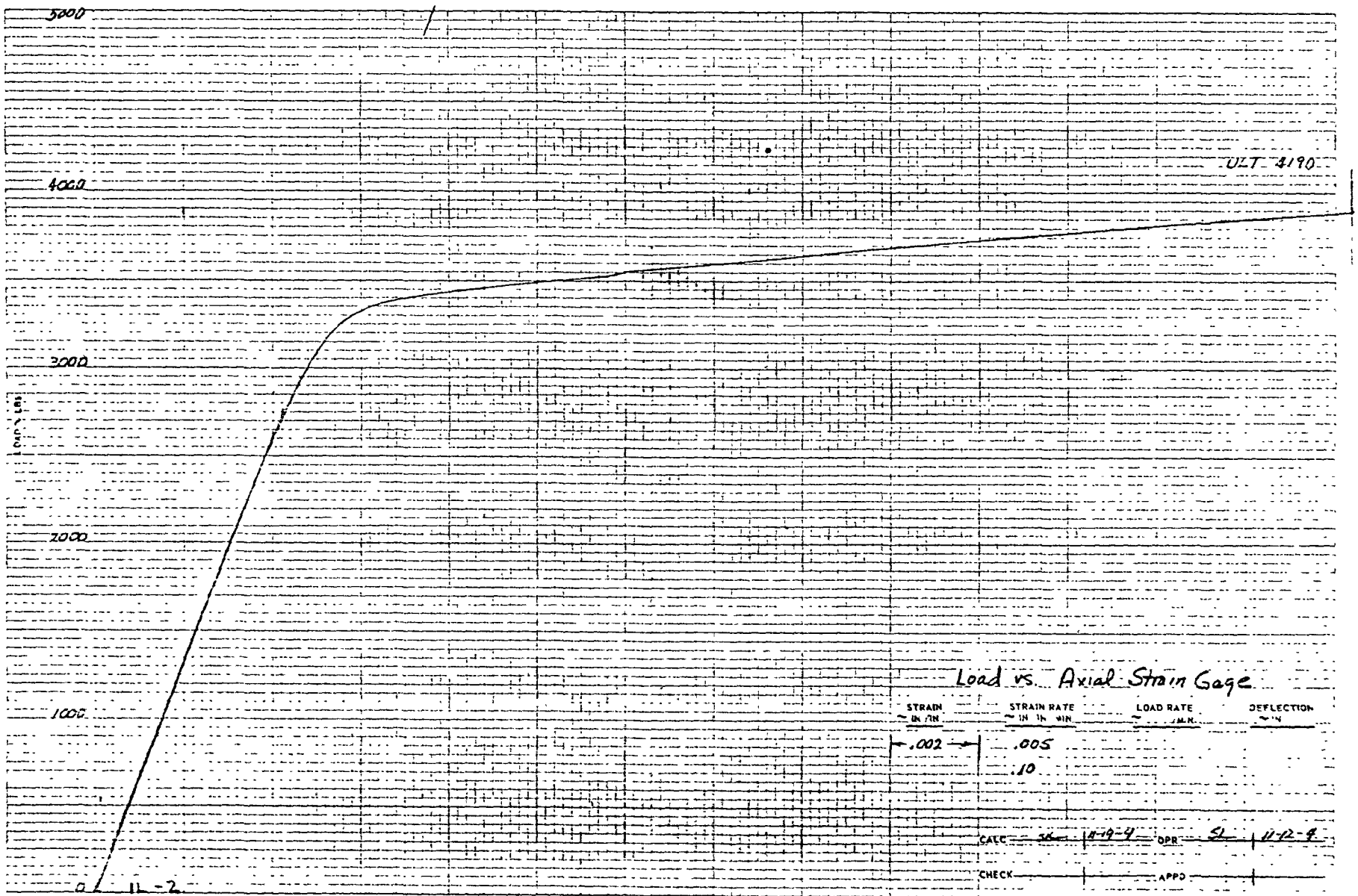

5000
4000
3000
2000
1000
0
LOAD ~ LBS
ULT = 4290.
IT-2
Load vs. Poisson Strain Gage
STRAIN ~ IN /IN
STRAIN RATE ~ IN /IN . MIN
LOAD RATE ~ #/MIN
DEFLECTION ~ "
.002
Compression
.005
.10
CALC SR 11-19-4
OPR SR 11-12-4
CHECK
APPD
BOEING
TPR
EWA
PAGE OF

259
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6000
4000
2000
0
LOAD, LBS
ULT. 4200
Load vs. Axial Strain Gage
STRAIN ~ IN /IN
STRAIN RATE ~ IN /IN /MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
IL-1
CALC
OPR
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF
A= .06194 in²

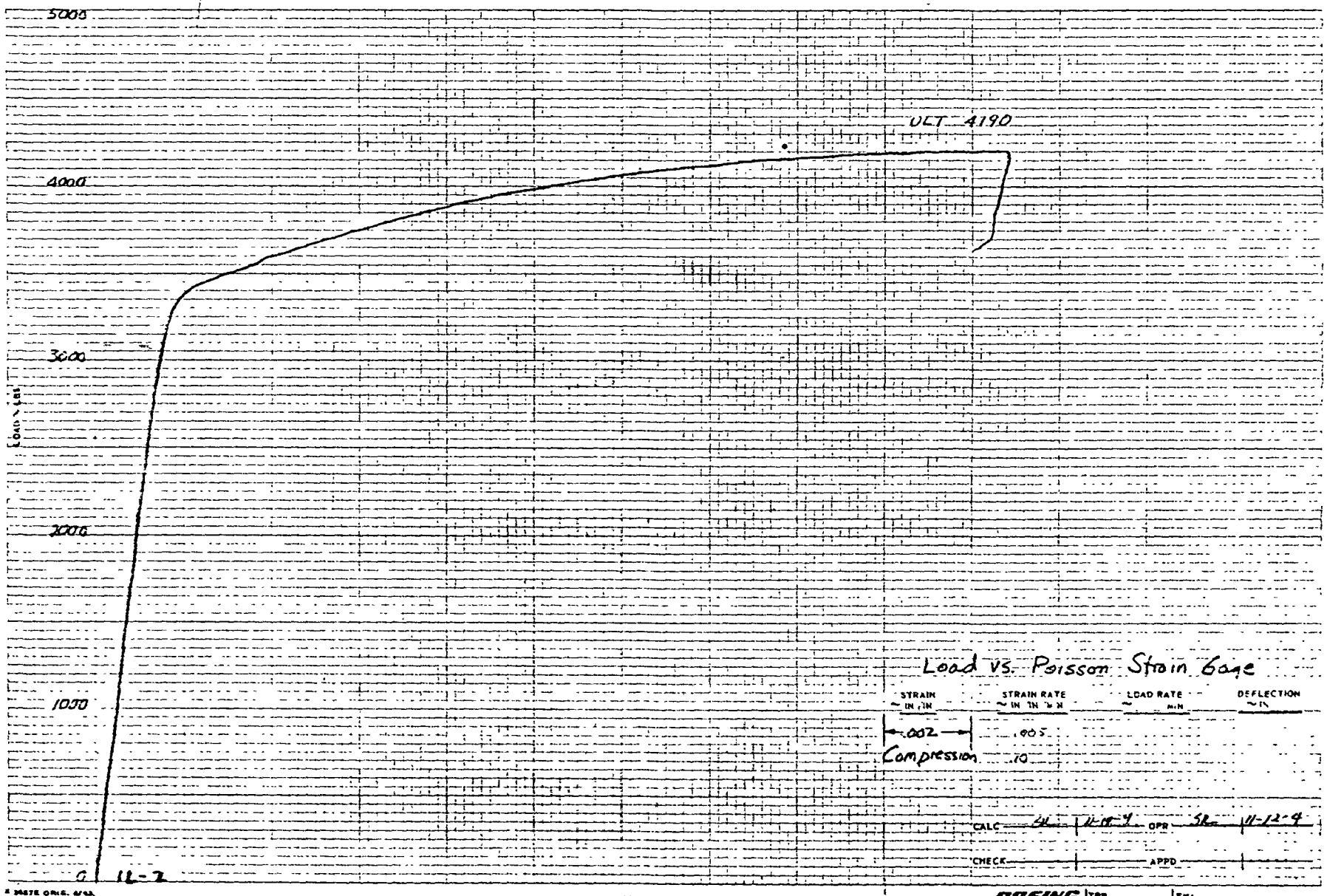

6000
4000
2000
0
JCT = 42.00
Load vs. Poisson Strain Gage
STRAIN IN./IN.
STRAIN RATE IN/IN/MIN
LOAD RATE #/MIN
DEFLECTION
.002
Compression
.205
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF


5000
4000
3000
2000
1000
0
LOAD, LBS
ULT 4190
11-2
Load vs. Axial Strain Gage
STRAIN IN/IN
STRAIN RATE IN/IN/MIN
LOAD RATE LBS/MIN
DEFLECTION IN
.002
.005
.10
CALC
DPR
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF

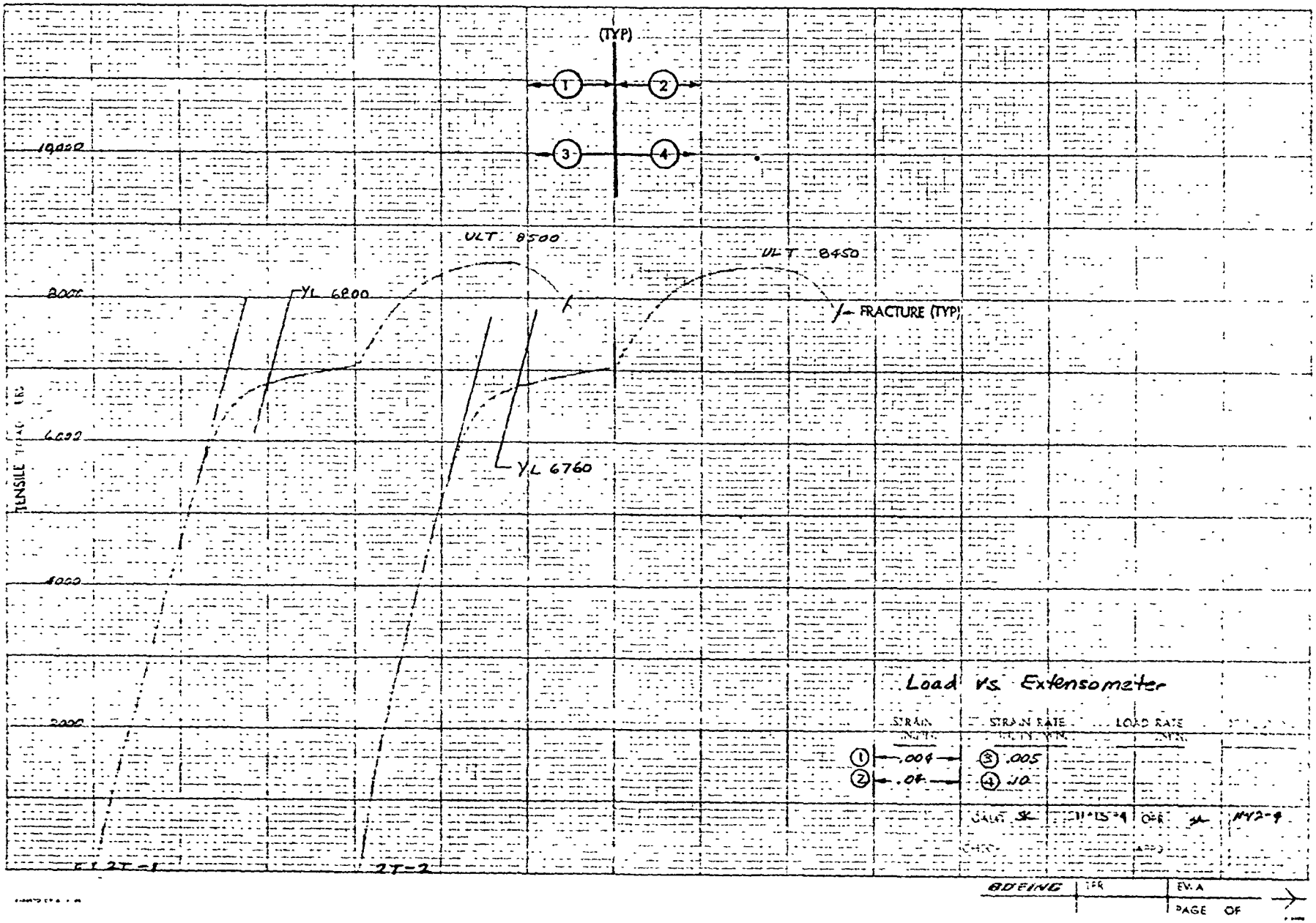
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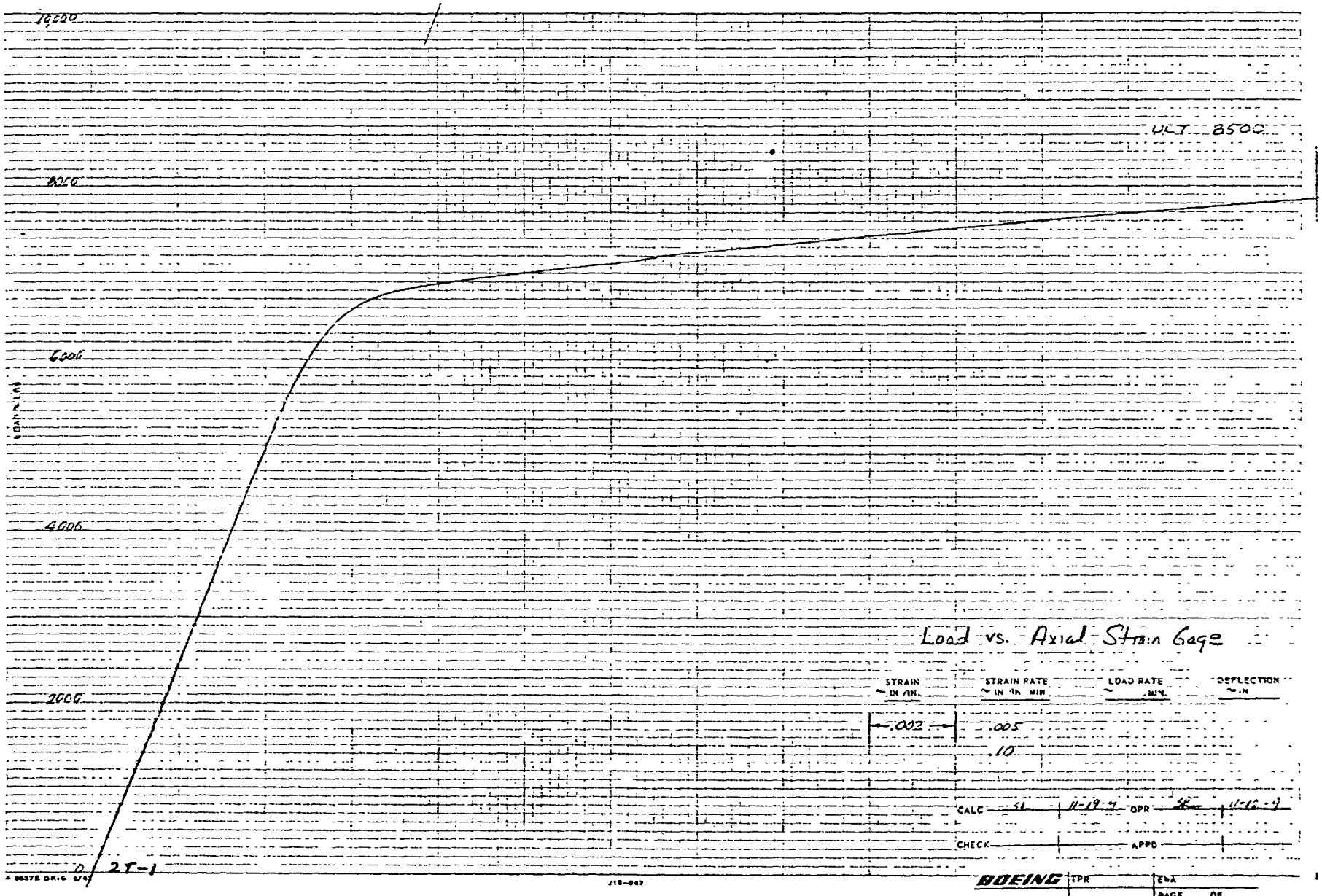
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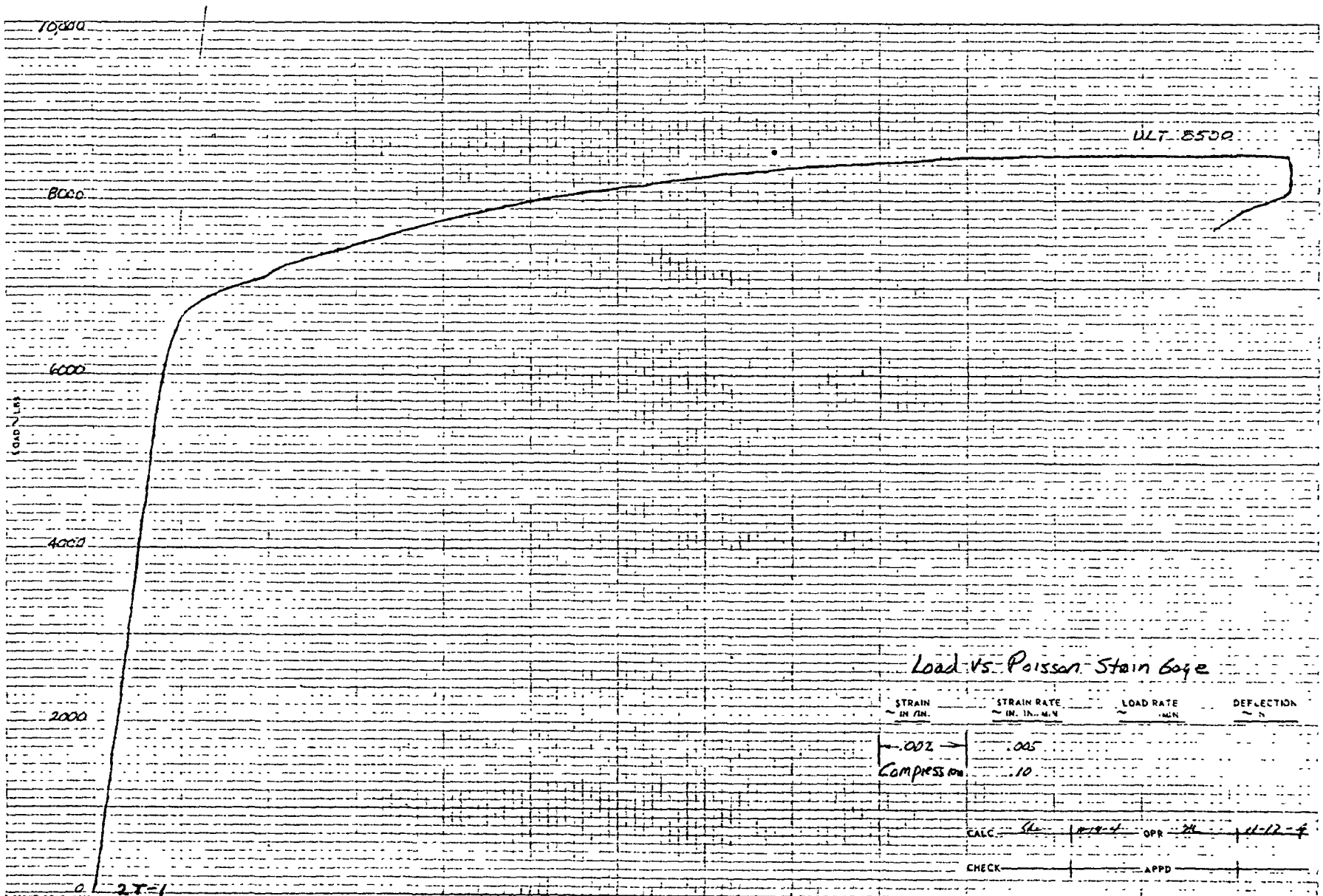
K&E


5000
4000
3000
2000
1000
0
Load - lbs
ULT 4190
IL-2
Load vs. Poisson Strain Gage
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN/MIN
LOAD RATE ~ #/MIN
DEFLECTION ~ IN
.002
Compression
.005
.10
CALC
11-10-9
OPR
11-12-9
CHECK
APPD
BOEING
TPR
EVA
PAGE
OF

for machine only




10000
8000
6000
4000
2000
0
LOAD ~ LBS
ULT 8500
2T-1
Load vs. Axial Strain Gage
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN/MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
CALC SL 11-19-7
OPR 11-12-7
CHECK
APPD
BOEING
TPR
EWA
PAGE OF



Load Vs. Poisson Stain Gage

STRAIN IN /IN.	STRAIN RATE ~ IN. IN. M.N	LOAD RATE ~ MIN	DEFLECTION ~ IN
.002 → Compression	.005		
	.10		

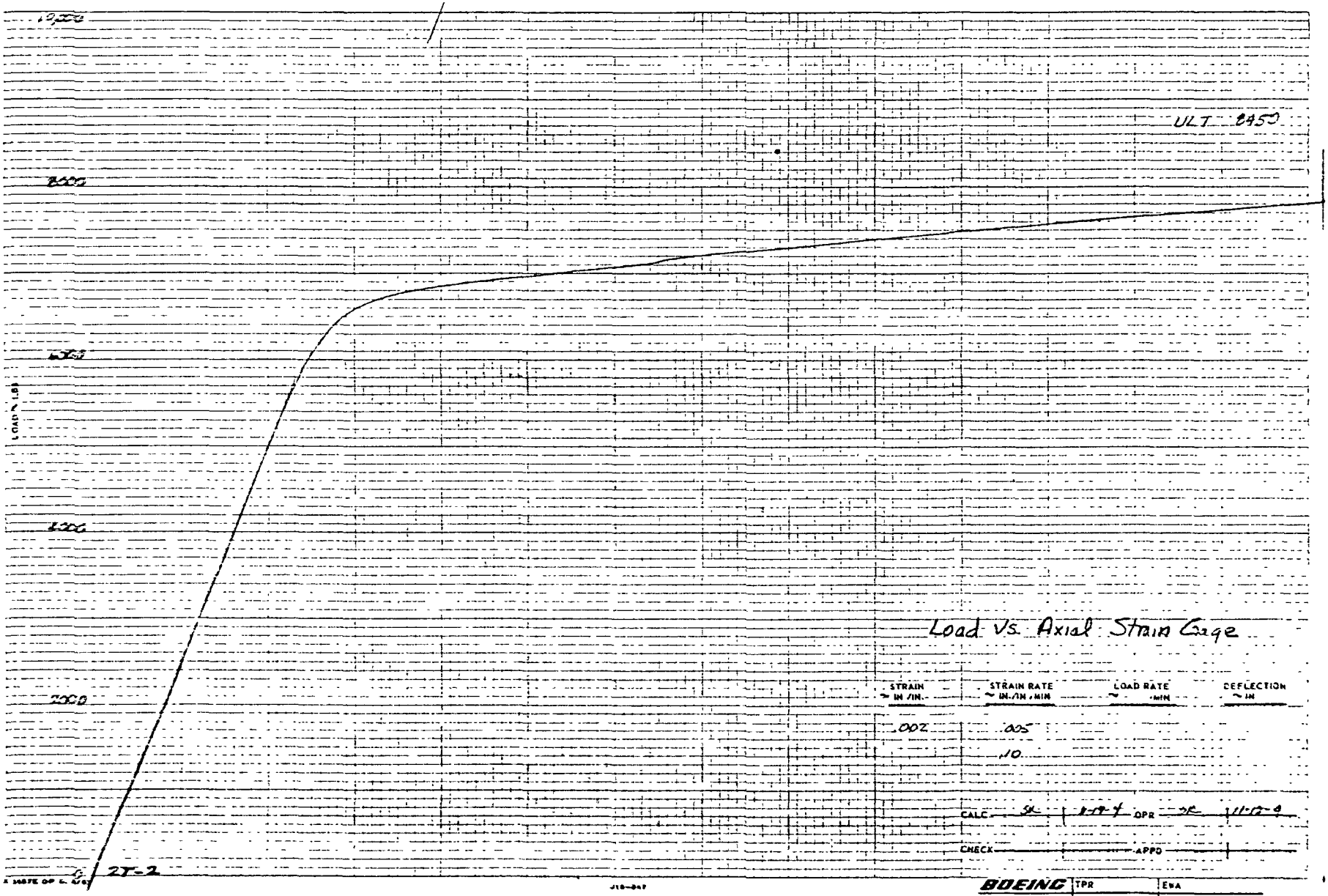
CALC SK 11-9-4 QPR JH 11-12-4

CHECK APPD

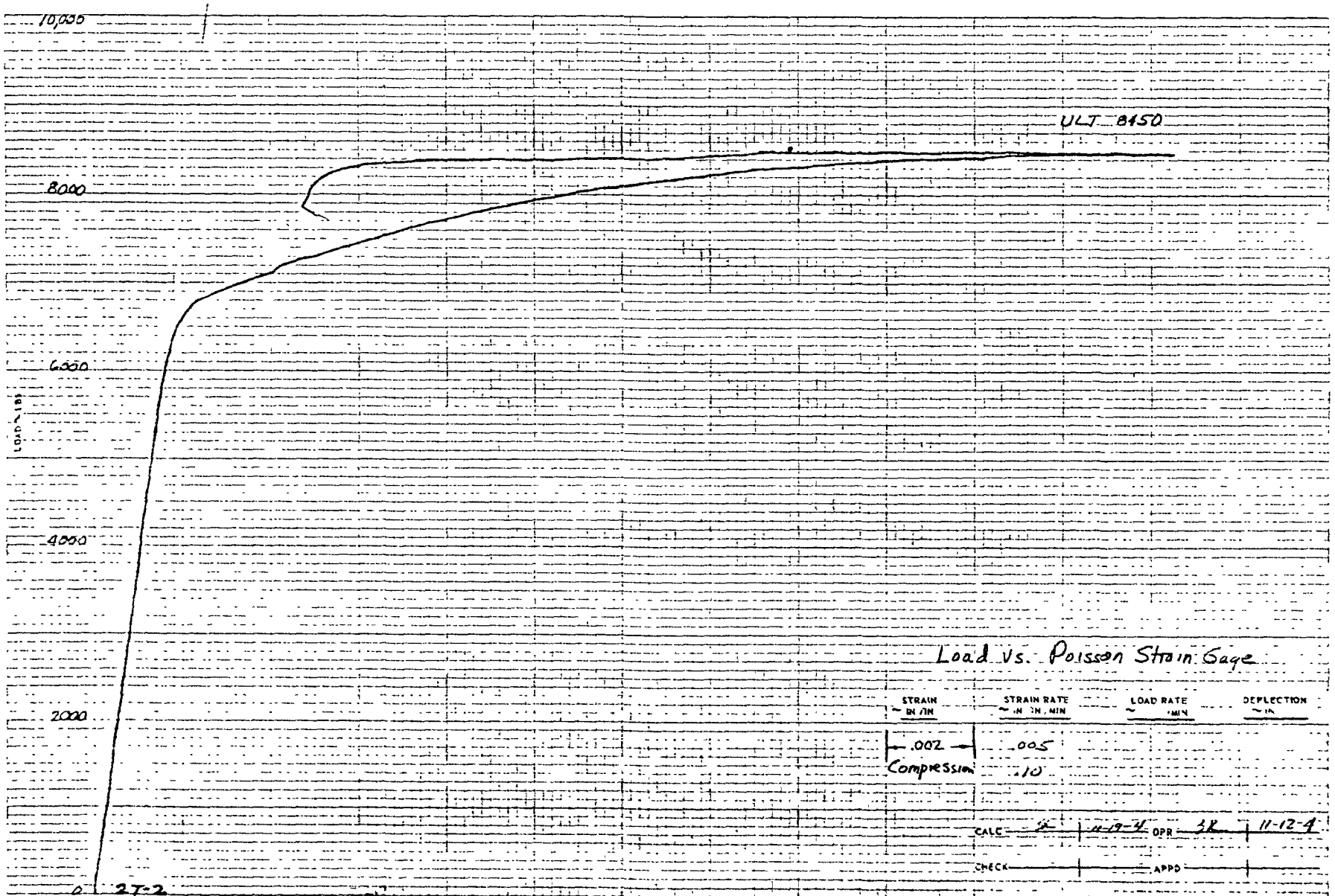
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J15-047

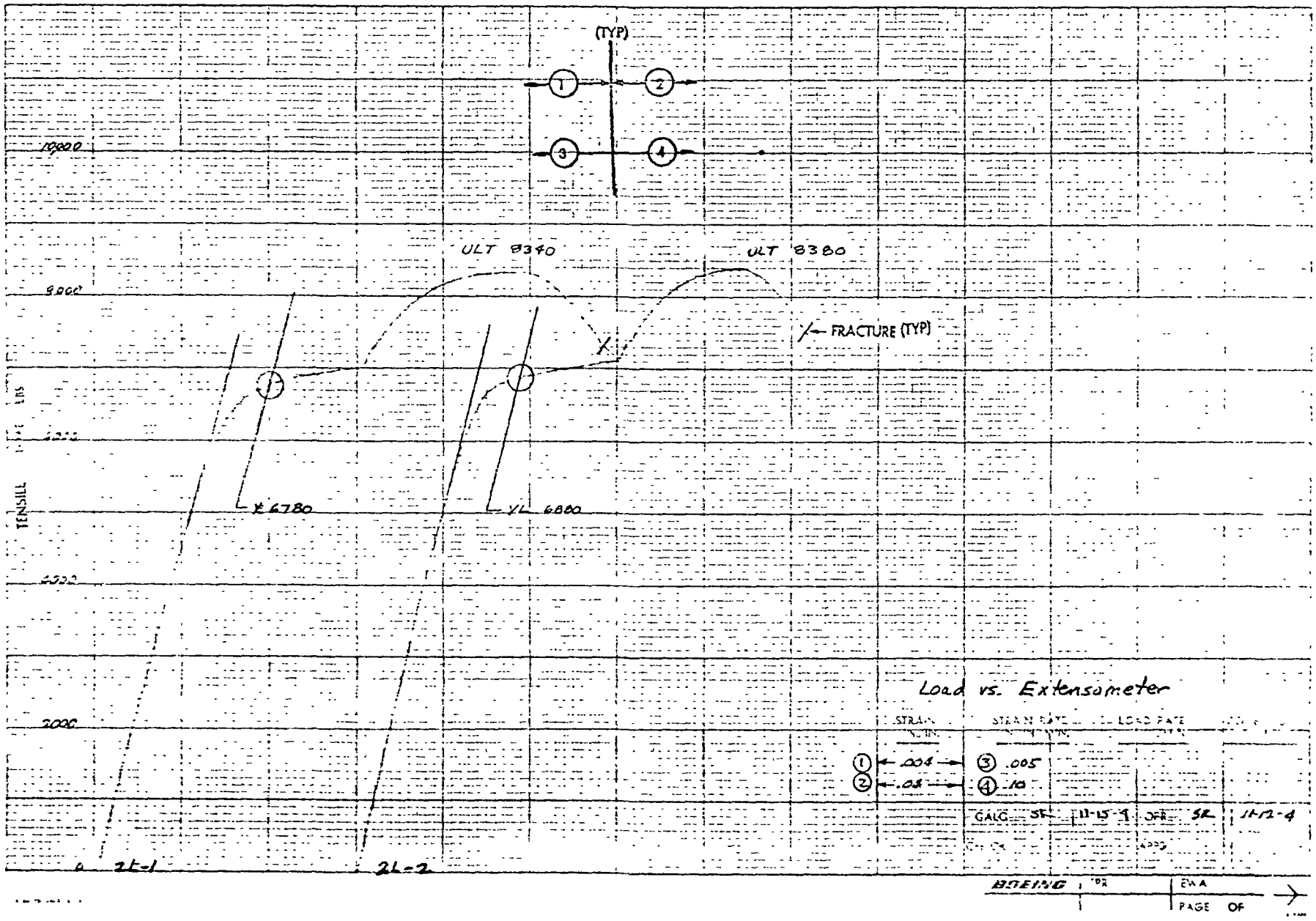
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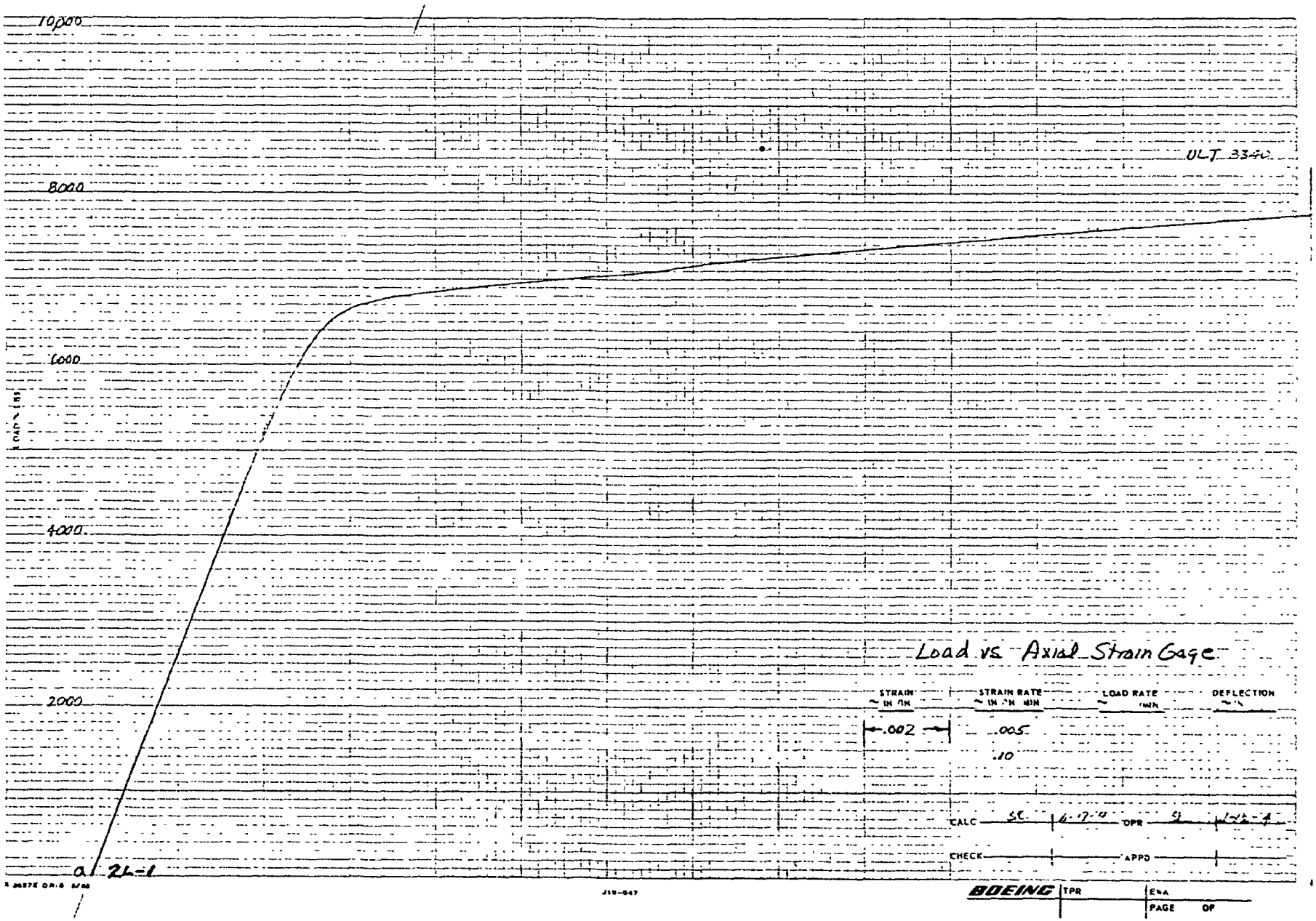

ULT 2450
2000
1500
1000
500
0
LOAD ~ LBS
2T-2
Load Vs. Axial Strain Gage
STRAIN ~ IN/IN.
STRAIN RATE ~ IN./IN./MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
CALC SK 1-19-7 DPR SK 11-12-9
CHECK APPD
BOEING TPR ENA
PAGE OF

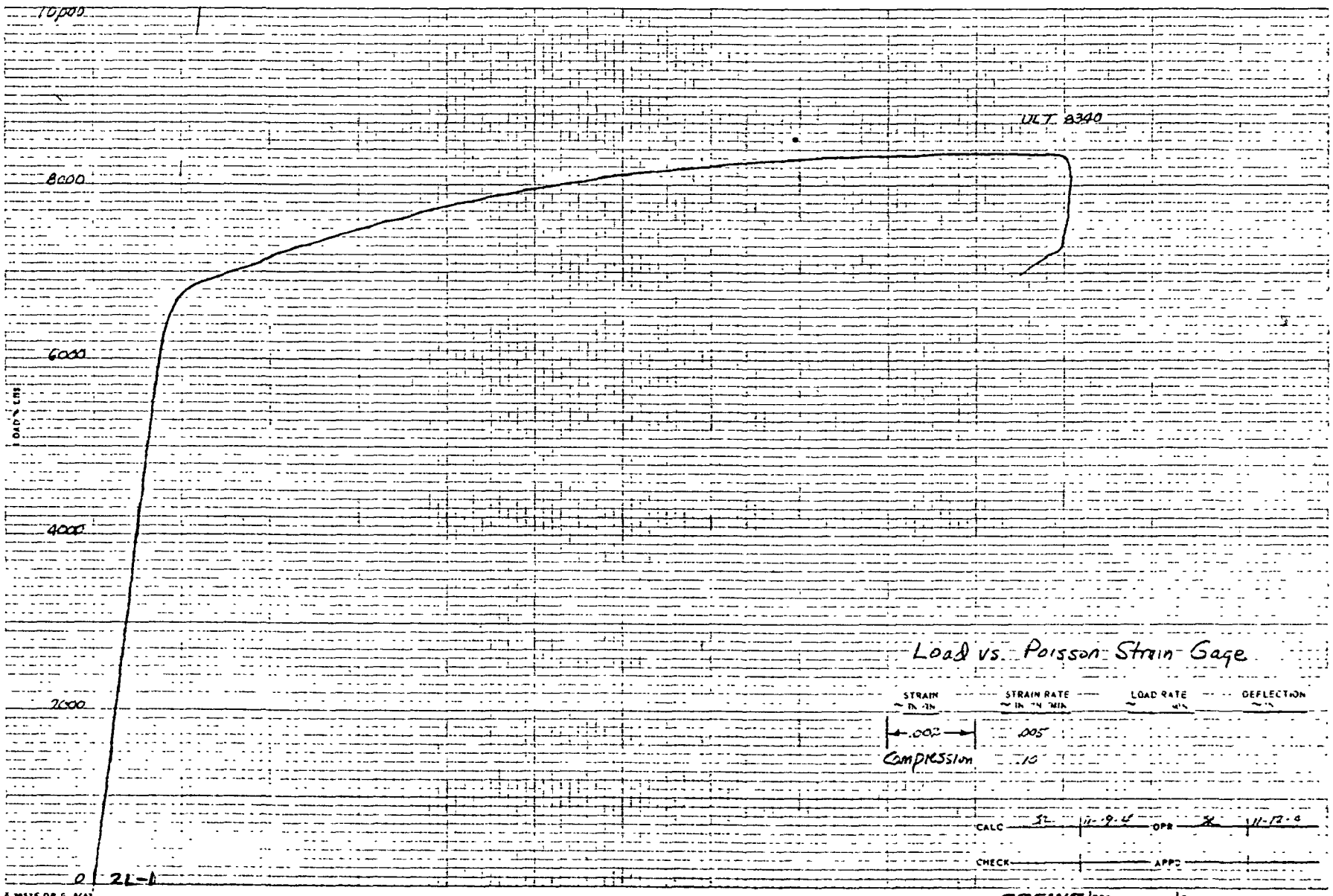
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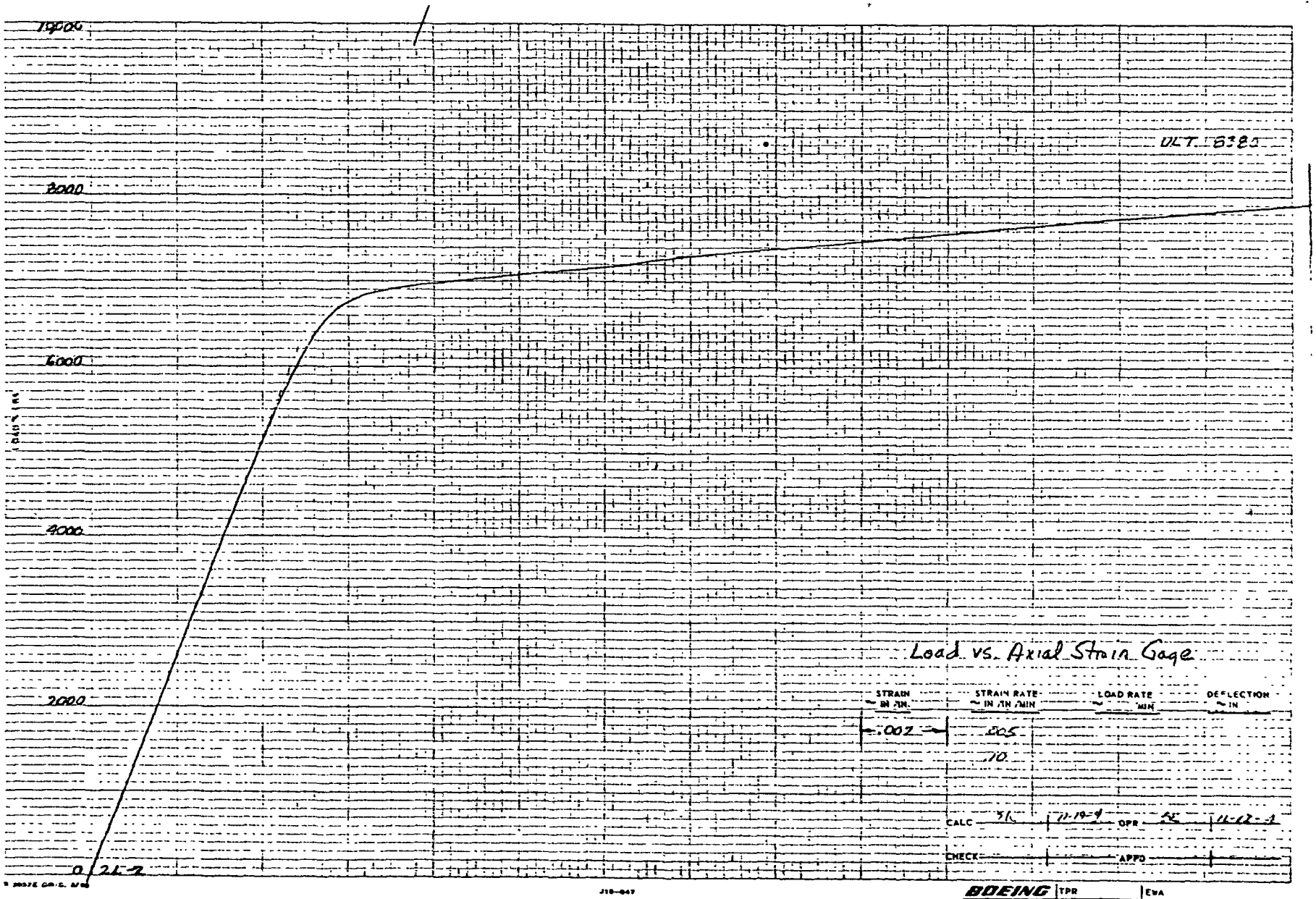

10,000
8000
6000
4000
2000
0
LOAD ~ LBS
ULT 8450
2T-2
Load vs. Poisson Strain Gage
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN, MIN
LOAD RATE ~ #/MIN
DEFLECTION ~ IN
.002
Compression
.005
.10
CALC
11-19-4
OPR
11-12-4
CHECK
APPD
BOEING
TPR
EGA
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OF

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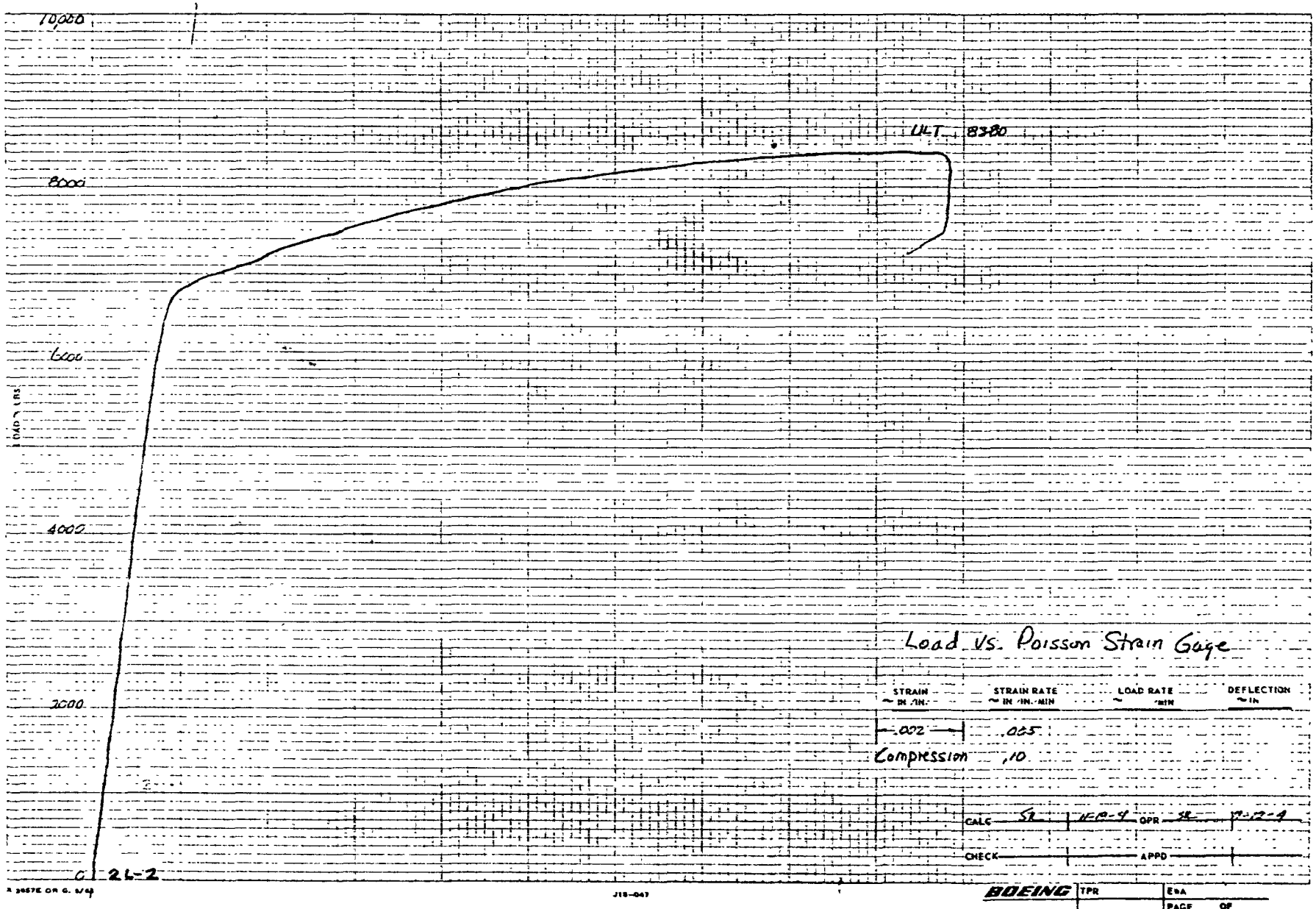

(TYP)
1
2
3
4
10000
9000
ULT 8340
ULT 8380
FRACTURE (TYP)
TENSILE LBS
6000
4000
2000
X 6780
Y 6880
2L-1
2L-2
Load vs. Extensometer
STRAIN
STRAIN RATE
LOAD RATE
① .004
② .08
③ .005
④ .10
GALG SR 11-15 1 OFF SR 11-12-4
BOEING
EWA
PAGE OF


10000
8000
6000
4000
2000
ULT 3340
Load vs Axial Strain Gage
STRAIN IN/IN
STRAIN RATE IN/IN MIN
LOAD RATE
DEFLECTION
.002
.005
.10
CALC
DPR
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF
2L-1

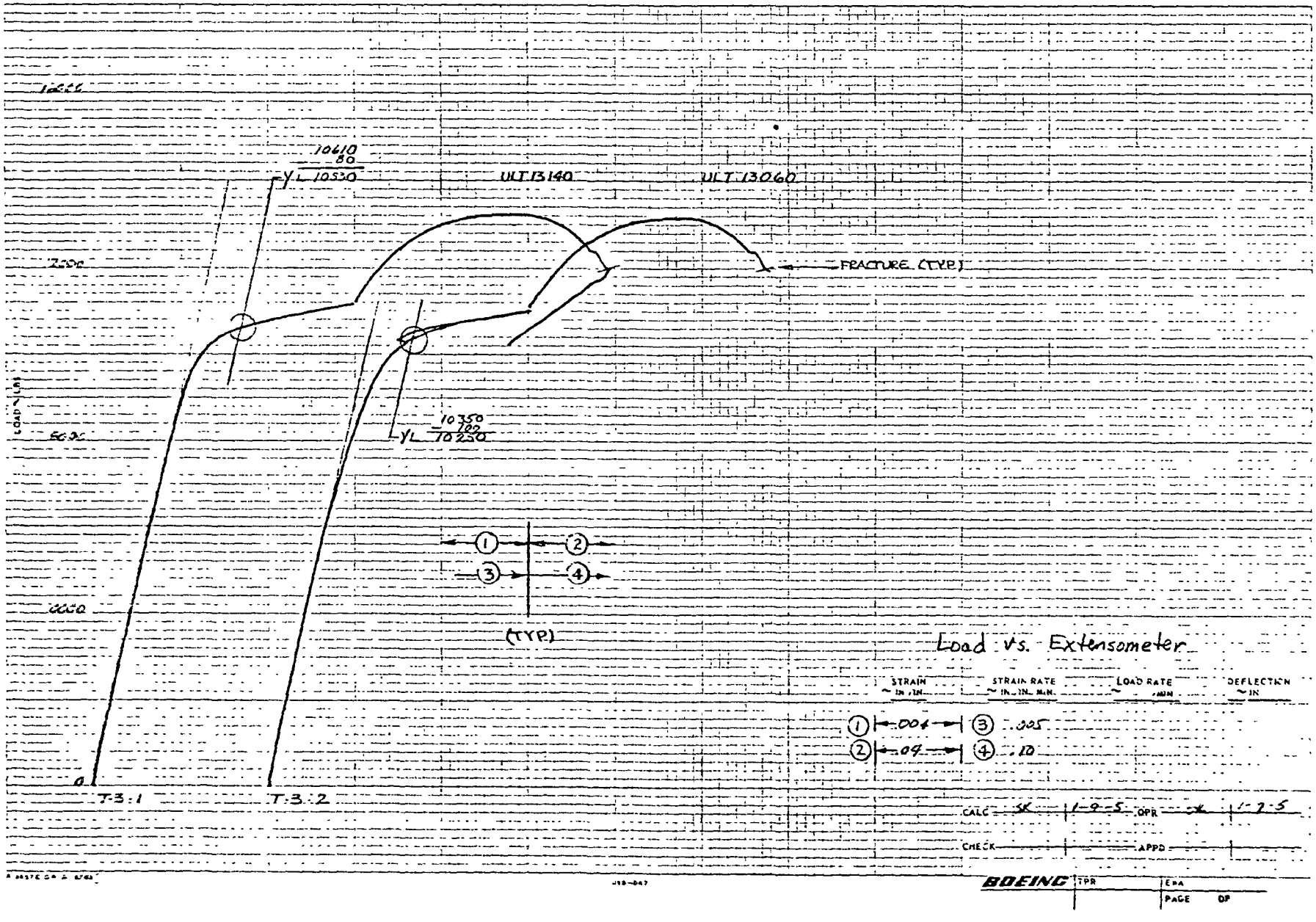

10,000
8000
6000
4000
2000
0
LOAD - LBS
ULT 8340
Load vs. Poisson Strain Gage
STRAIN
STRAIN RATE
LOAD RATE
DEFLECTION
.002
Compression
.005
.10
CALC
OPR
CHECK
APPD
2L-1
BOEING
TPR
ENG
PAGE
OF

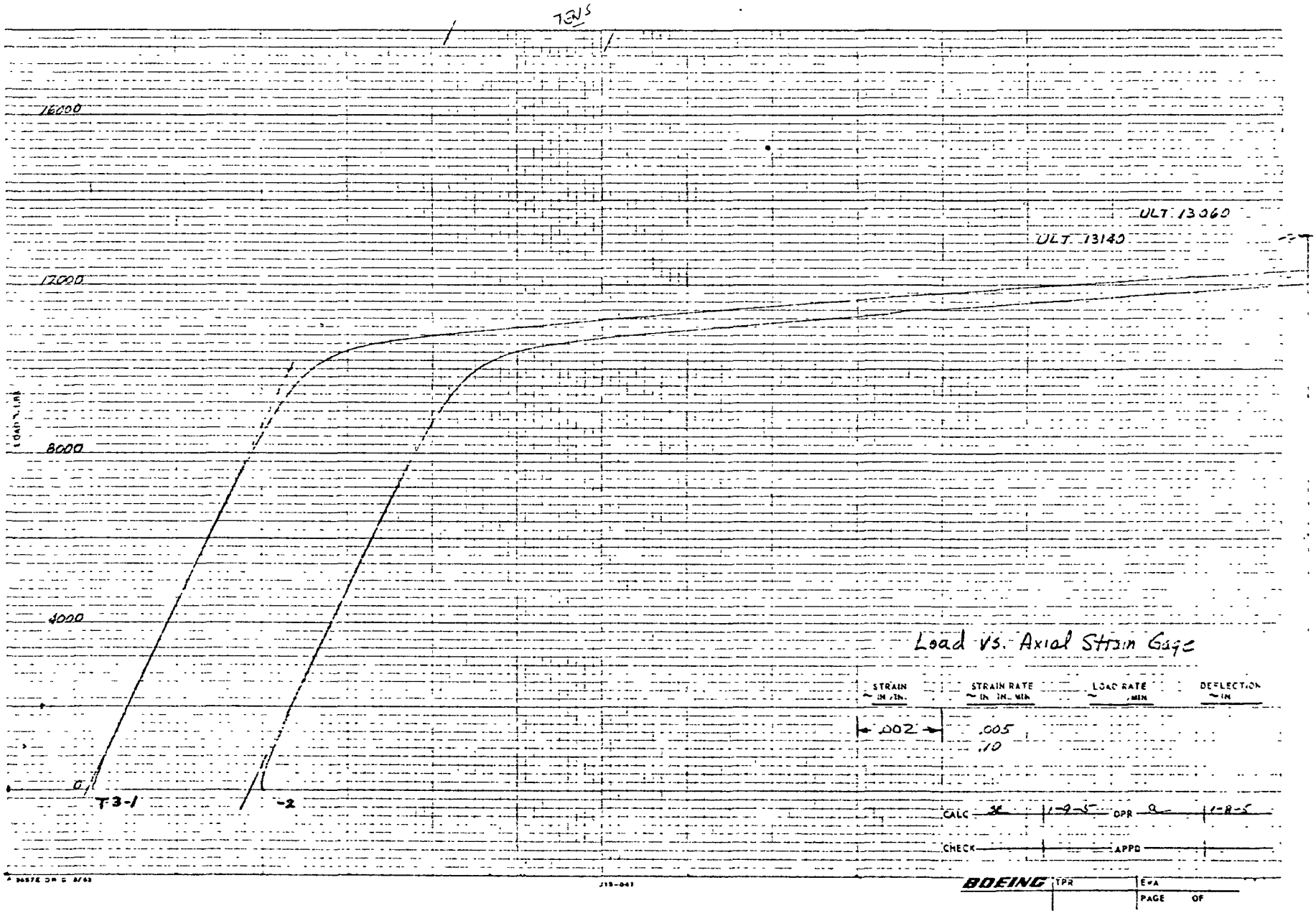


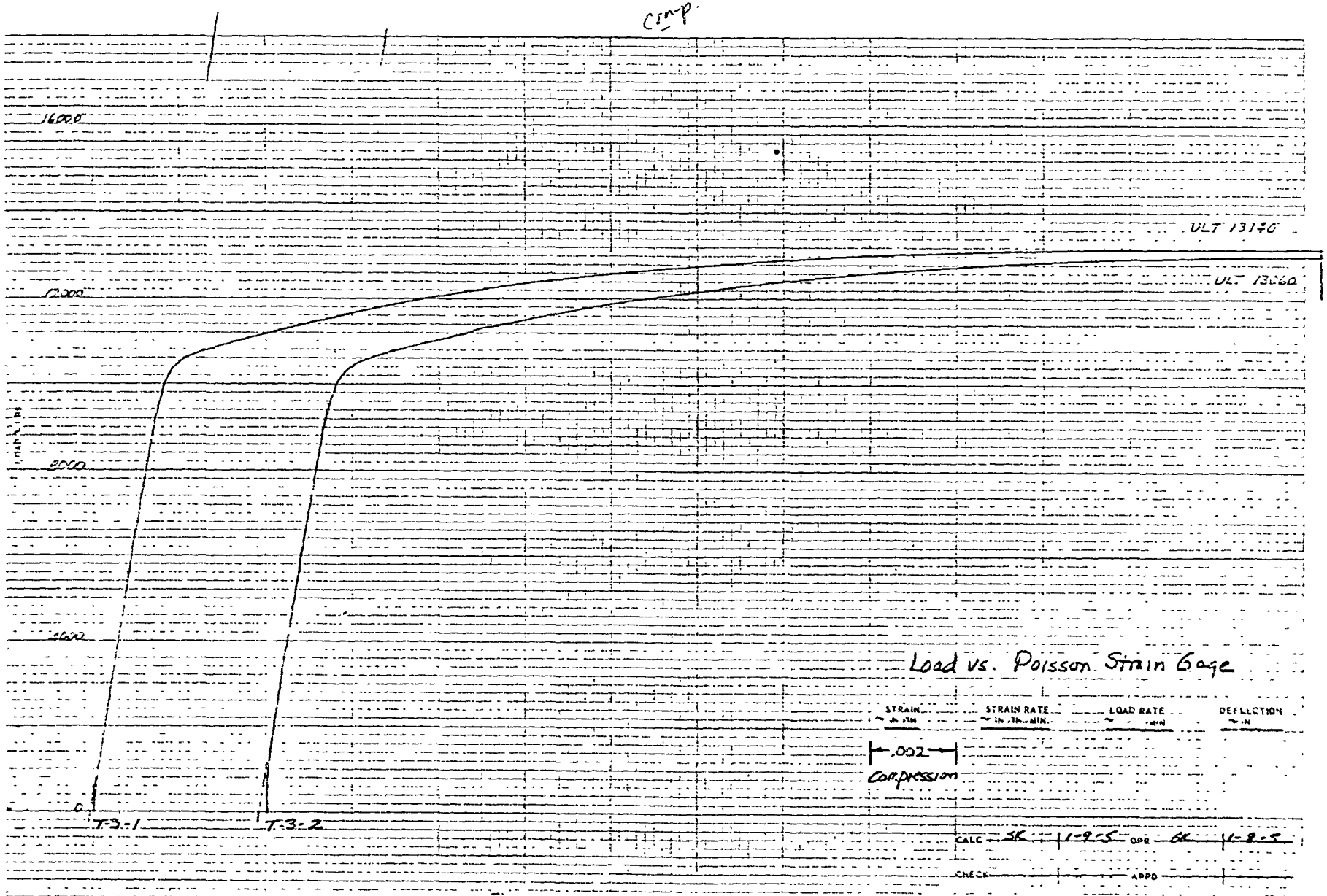
BOEING | TPR | EWA | PAGE OF



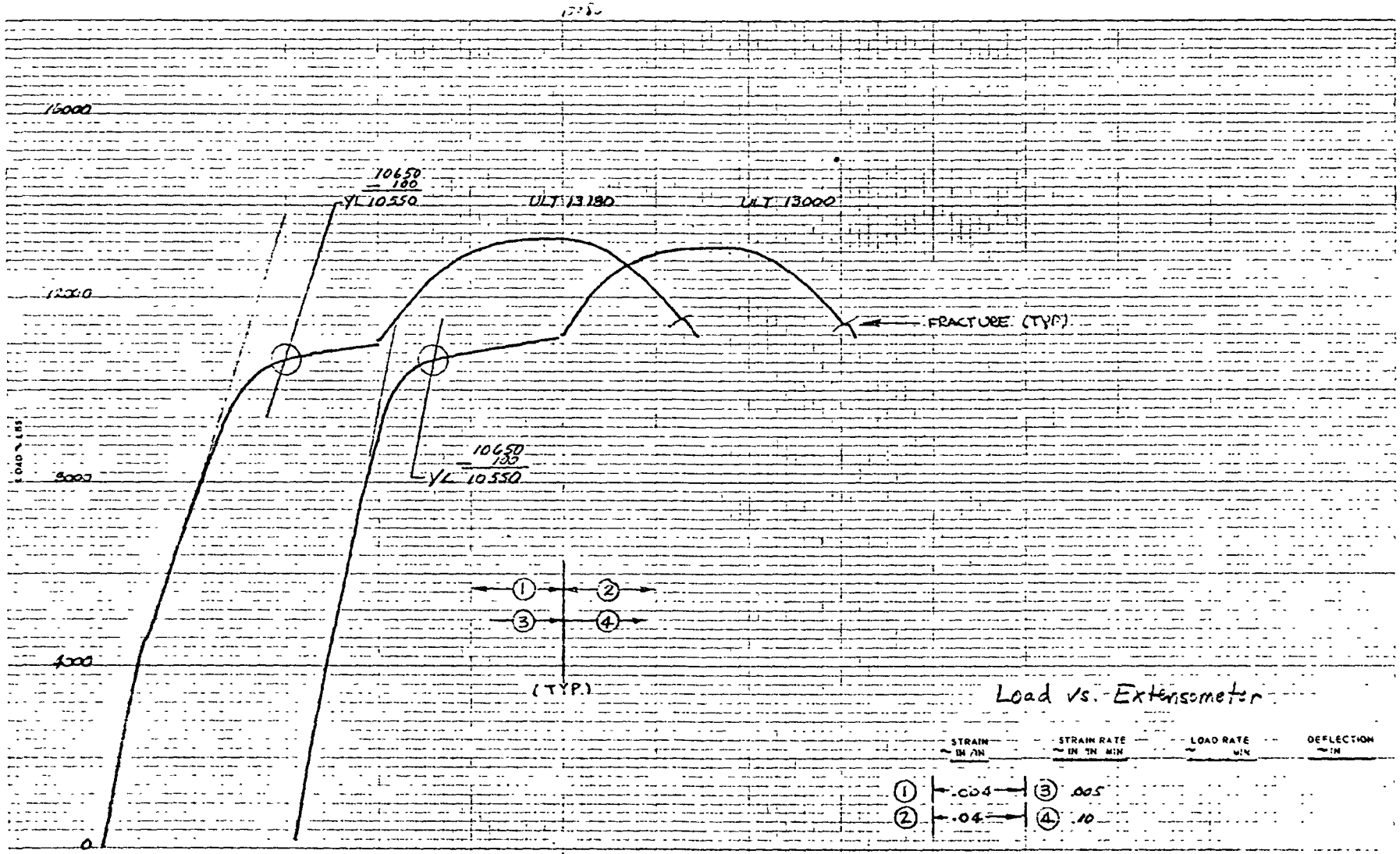
A 2657E OR G. 6/49
J18-047

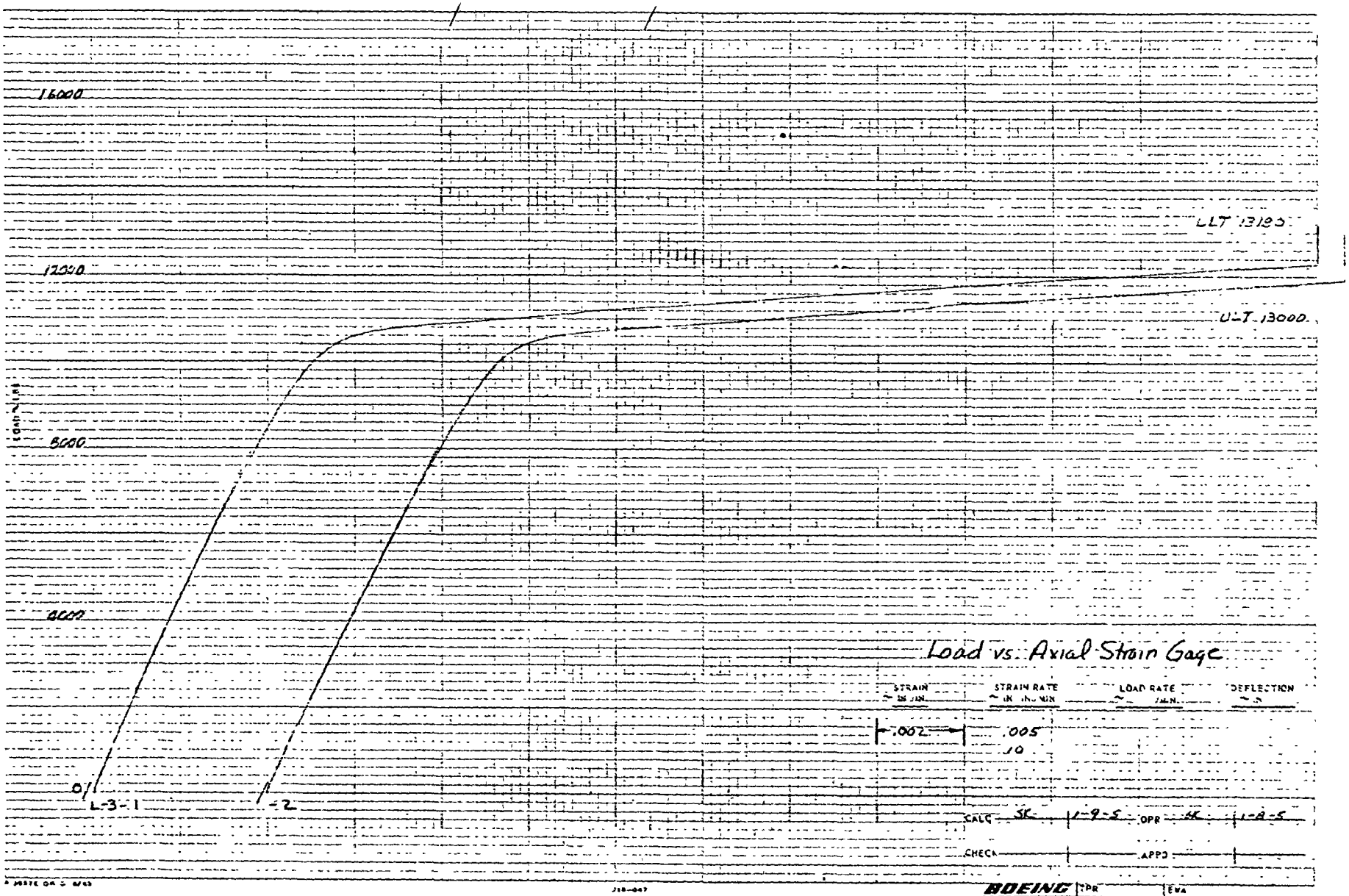

10610
80
YL 10530
ULT 13140
ULT 13060
FRACTURE (TYP.)
10350
100
YL 10250
(TYP.)
Load vs. Extensometer
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN. MIN.
LOAD RATE ~ /MIN
DEFLECTION ~ IN
① .004 ③ .005
② .04 ④ .10
T-3:1
T-3:2
CALC SK 1-9-5
OPR SK 1-2-5
CHECK
APPD
BOEING
TPR
EPA
PAGE OF

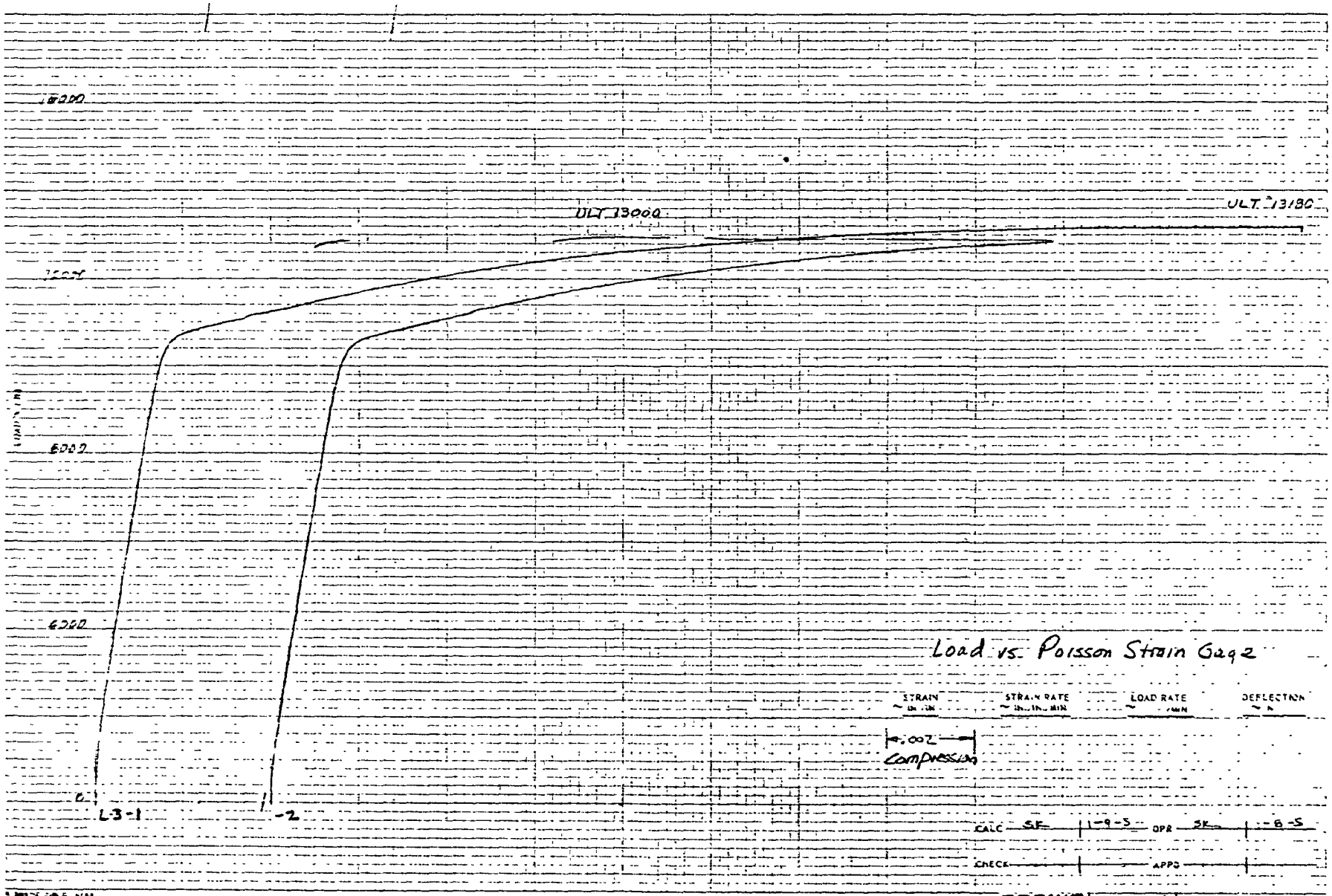

TENS
16000
12000
8000
4000
0
LOAD - LBS
ULT. 13060
ULT. 13140
T3-1
-2
Load Vs. Axial Strain Gage
STRAIN IN./IN.
STRAIN RATE IN. IN./MIN.
LOAD RATE /MIN.
DEFLECTION IN.
.002
.005
.10
CALC
DPR
CHECK
APPD
BOEING
TPR
EVA
PAGE
OF


Comp.
16000
12000
8000
4000
0
ULT 13140
ULT 13060
T-3-1
T-3-2
Load vs. Poisson Strain Gage
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN-MIN.
LOAD RATE ~ LB/MIN
DEFLECTION ~ IN
.002
Compression
CALC SK 1-9-5
DPR GK 1-8-5
CHECK
APPD
BOEING
TPR
ENG
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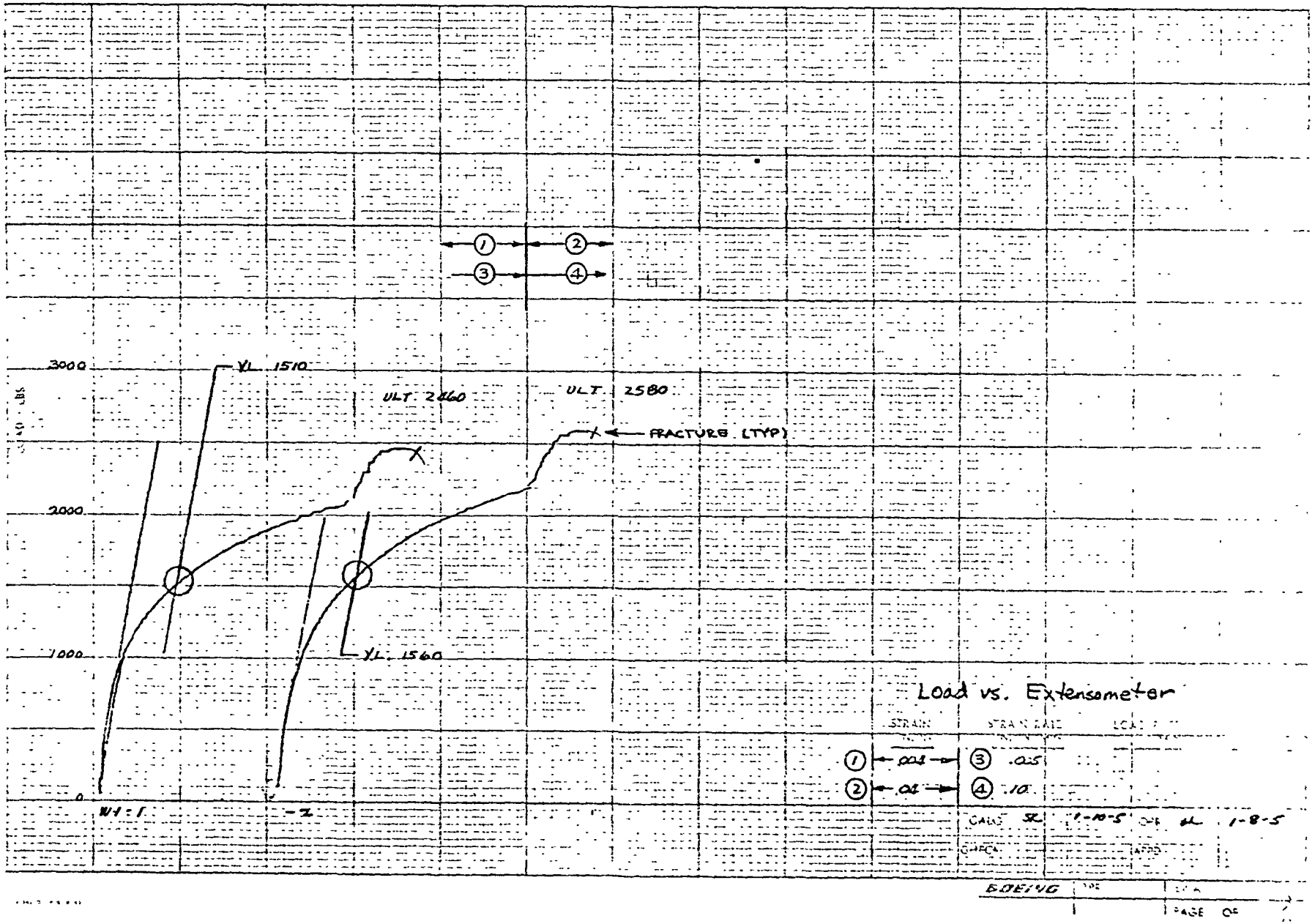
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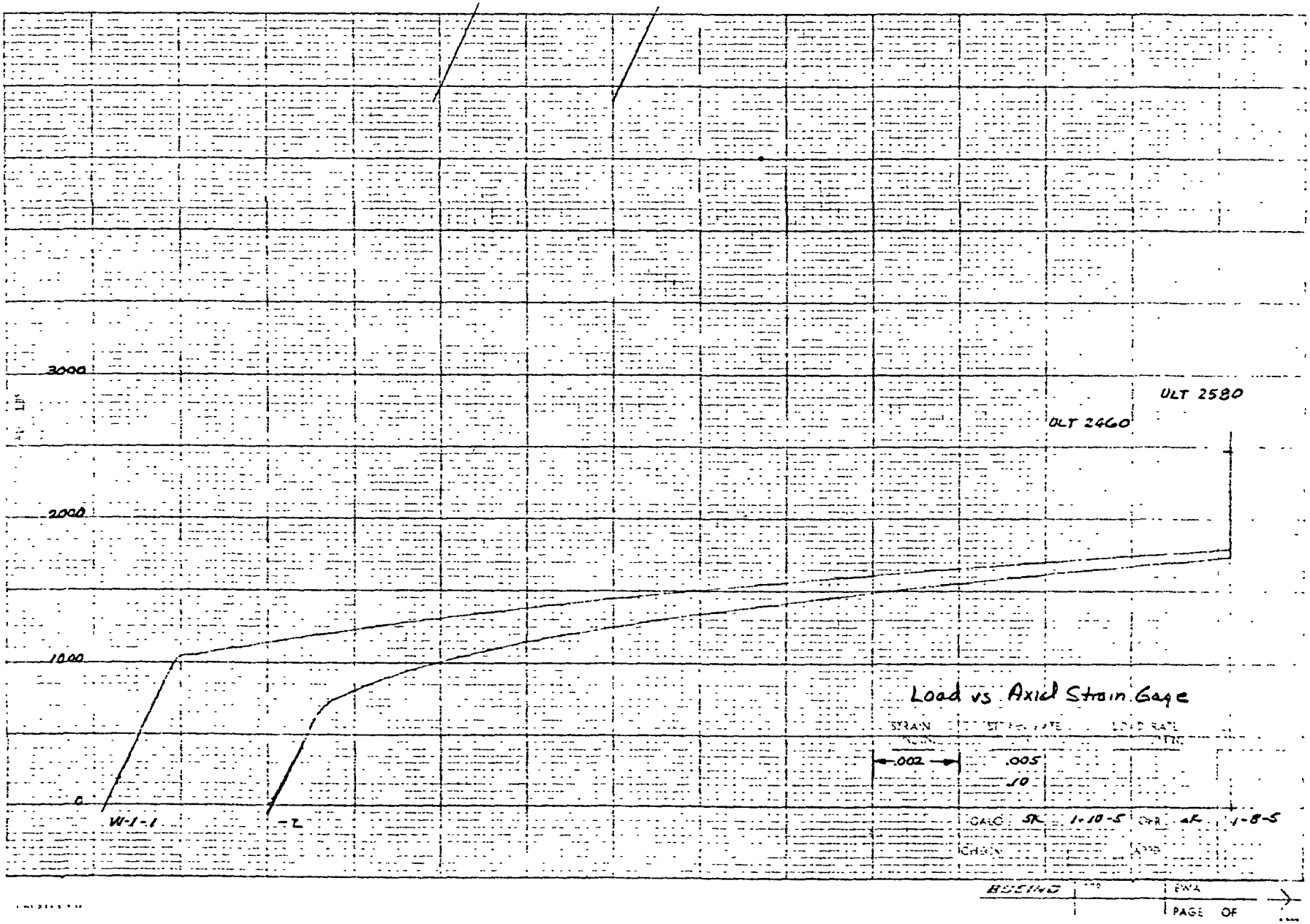

16000
12000
8000
4000
0
LOAD - LBS
10650 / 100
YL 10550
ULT 13180
ULT 13000
FRACTURE (TYP)
10650 / 133
YL 10550
1
2
3
4
(TYP)
L3-1
-2
Load vs. Extensometer
STRAIN IN/IN
STRAIN RATE IN IN MIN
LOAD RATE LBS MIN
DEFLECTION IN
1 .004 3 .005
2 .04 4 .10
CALC SR 1-9-5
OPR SR 1-9-5
CHECK
APPD
BOEING
TPR
ENG
PAGE OF


16000
12000
8000
4000
0
L-3-1
-2
ULT 13190
ULT 13000
EQUIVALENT
Load vs. Axial Strain Gage
STRAIN
STRAIN RATE
LOAD RATE
DEFLECTION
.002
.005
.10
CALC SK 1-9-5
OPR AK 1-9-5
CHECK
APPD
BOEING
TPR
EWA
PAGE OF

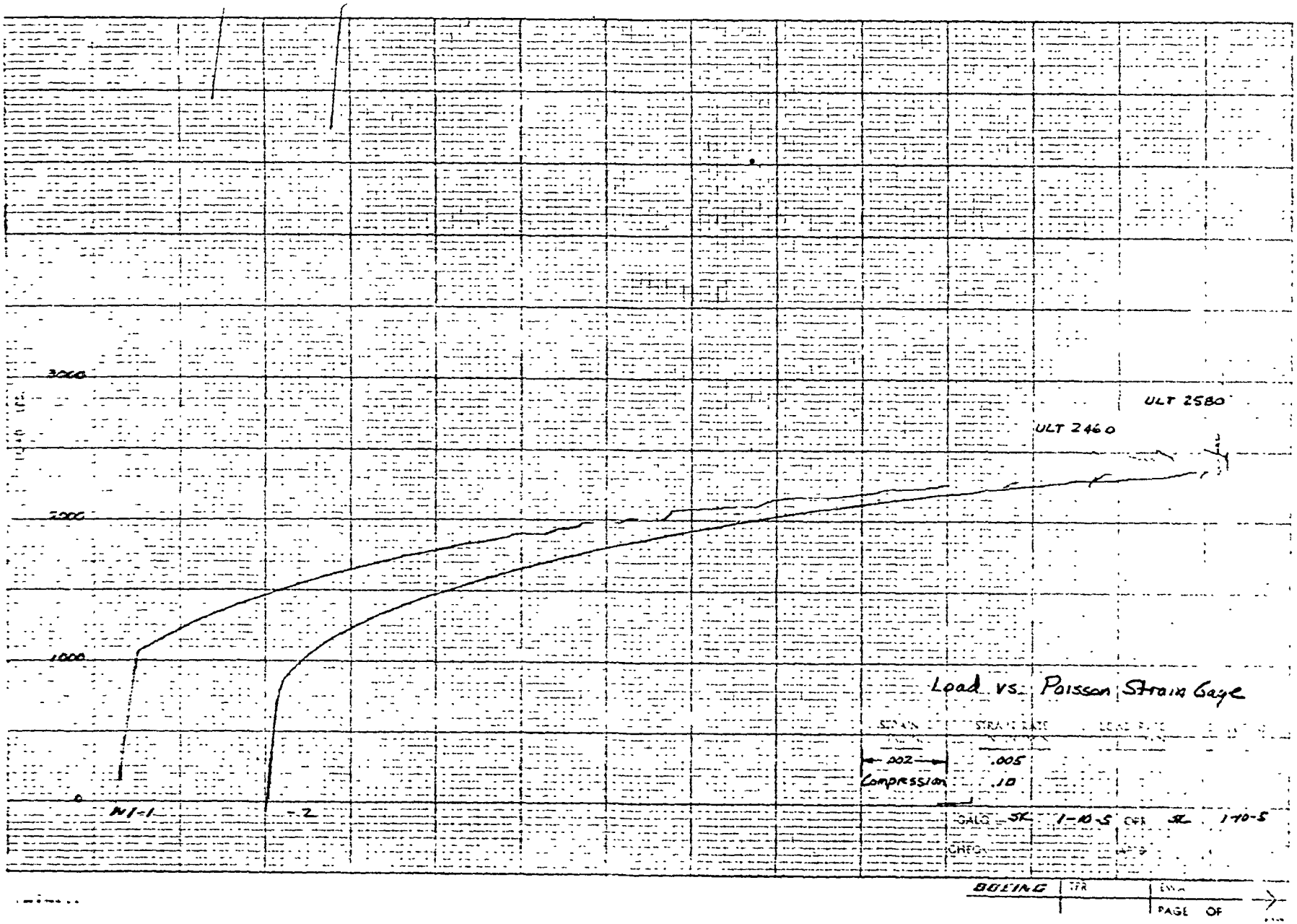

8000
ULT 13000
ULT 13180
6000
4000
0
L3-1
-2
Load vs. Poisson Strain Gage
STRAIN
STRAIN RATE
LOAD RATE
DEFLECTION
.002
Compression
CALC SF 1-9-5 DPR SK 1-8-5
CHECK APPD
BOEING TPR Eng
PAGE OF

279

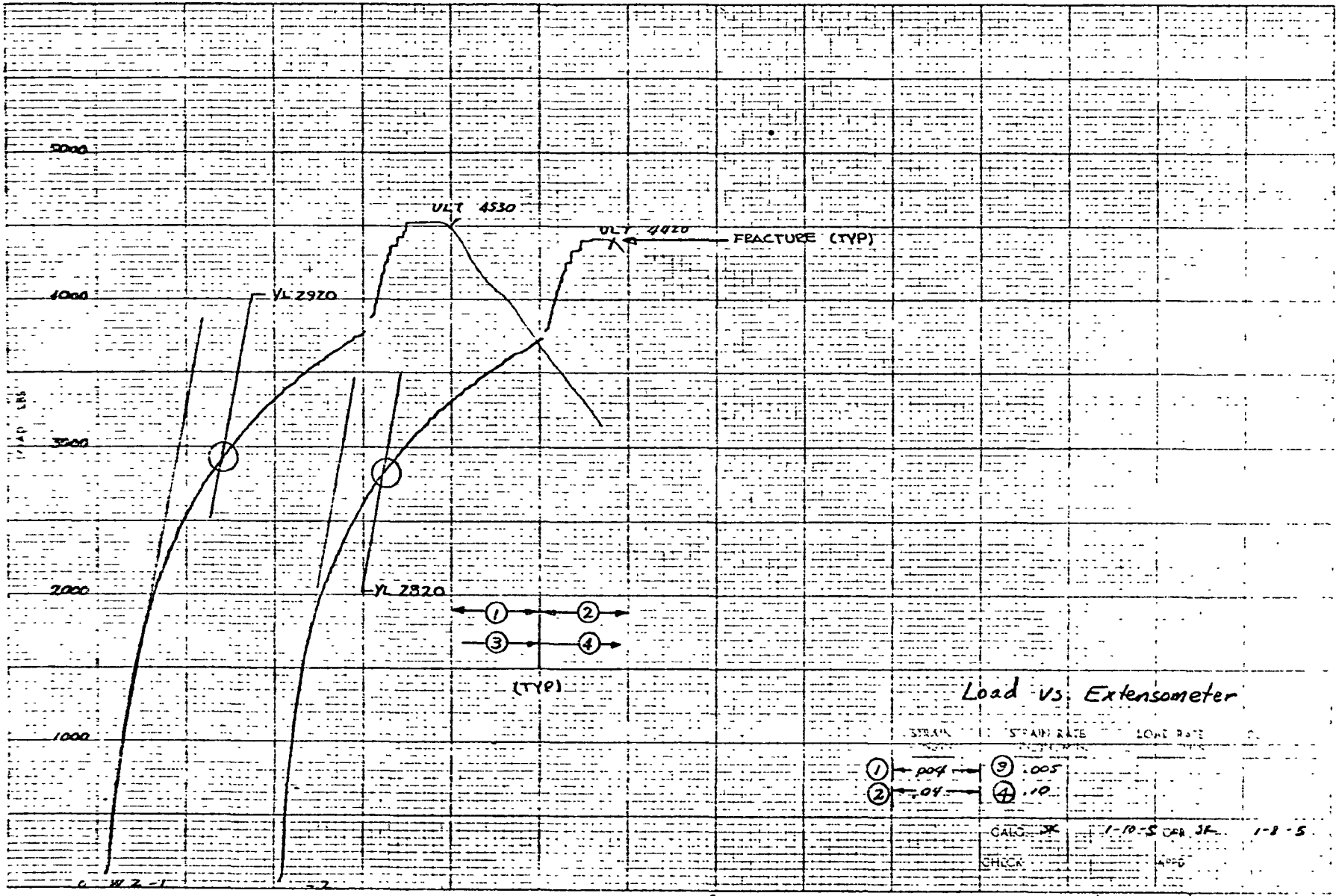

3000
2000
1000
0
YL 1510
ULT. 2460
ULT. 2580
FRACTURE (TYP)
YL 1560
Load vs. Extensometer
STRAIN
STRAIN RATE
.005
.01
.015
.10
GAGE SR 1-10-5
1-8-5
BOEING

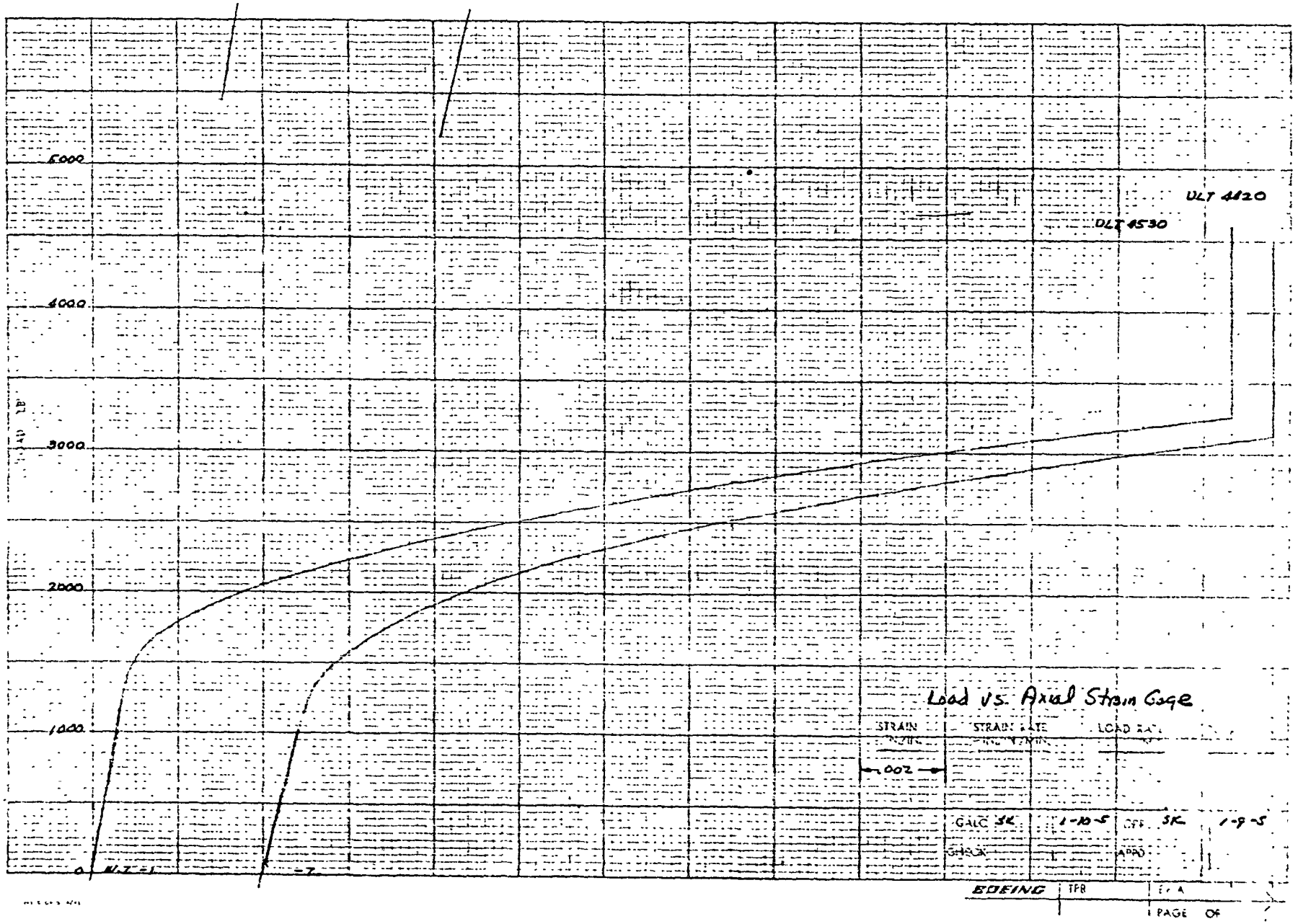

3000
2000
1000
0
ULT 2580
ULT 2460
Load vs Axial Strain Gage
STRAIN
.002
.005
.010
W-1-1
-2
BOEING
EWA
PAGE OF

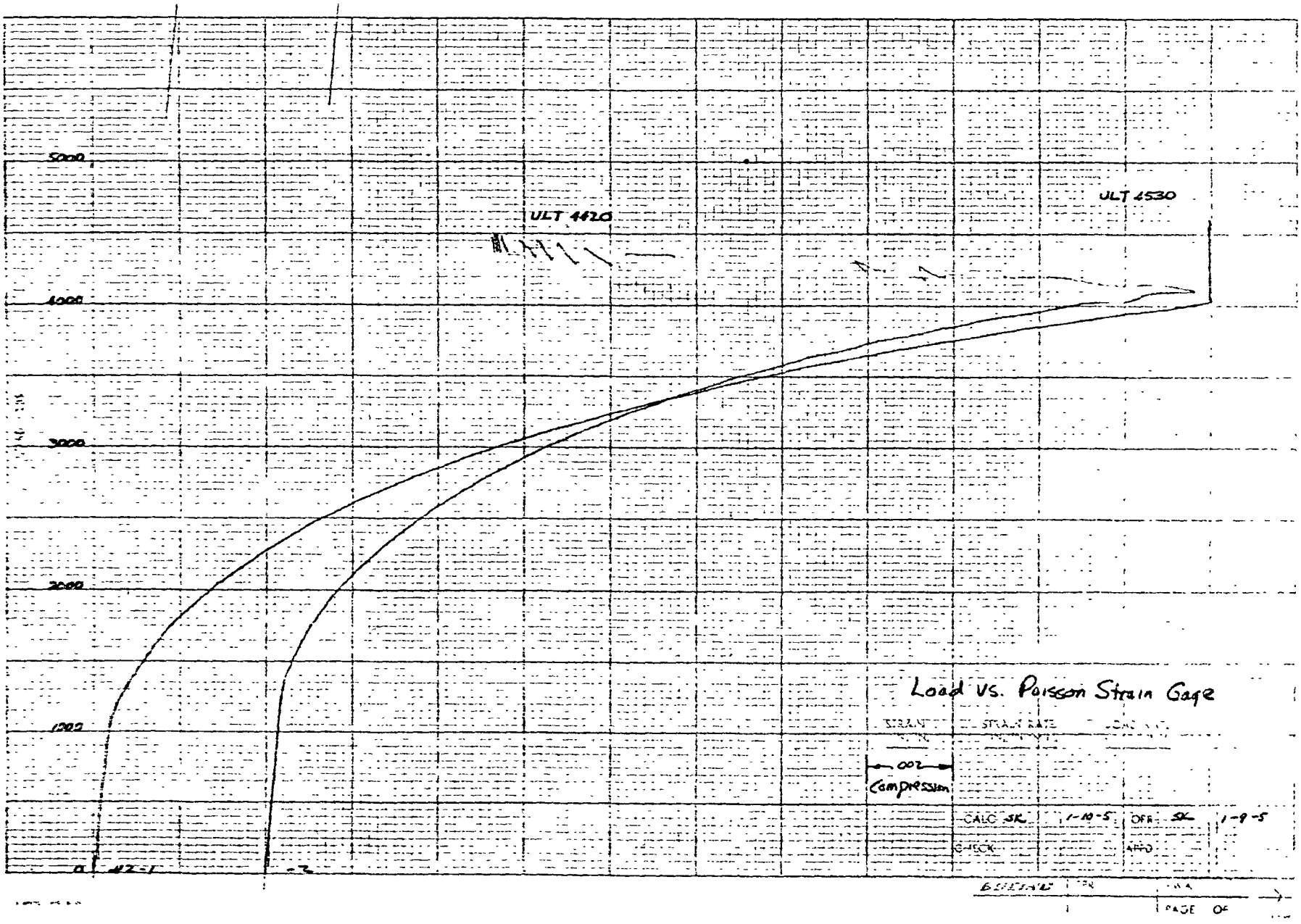
282
For machine only

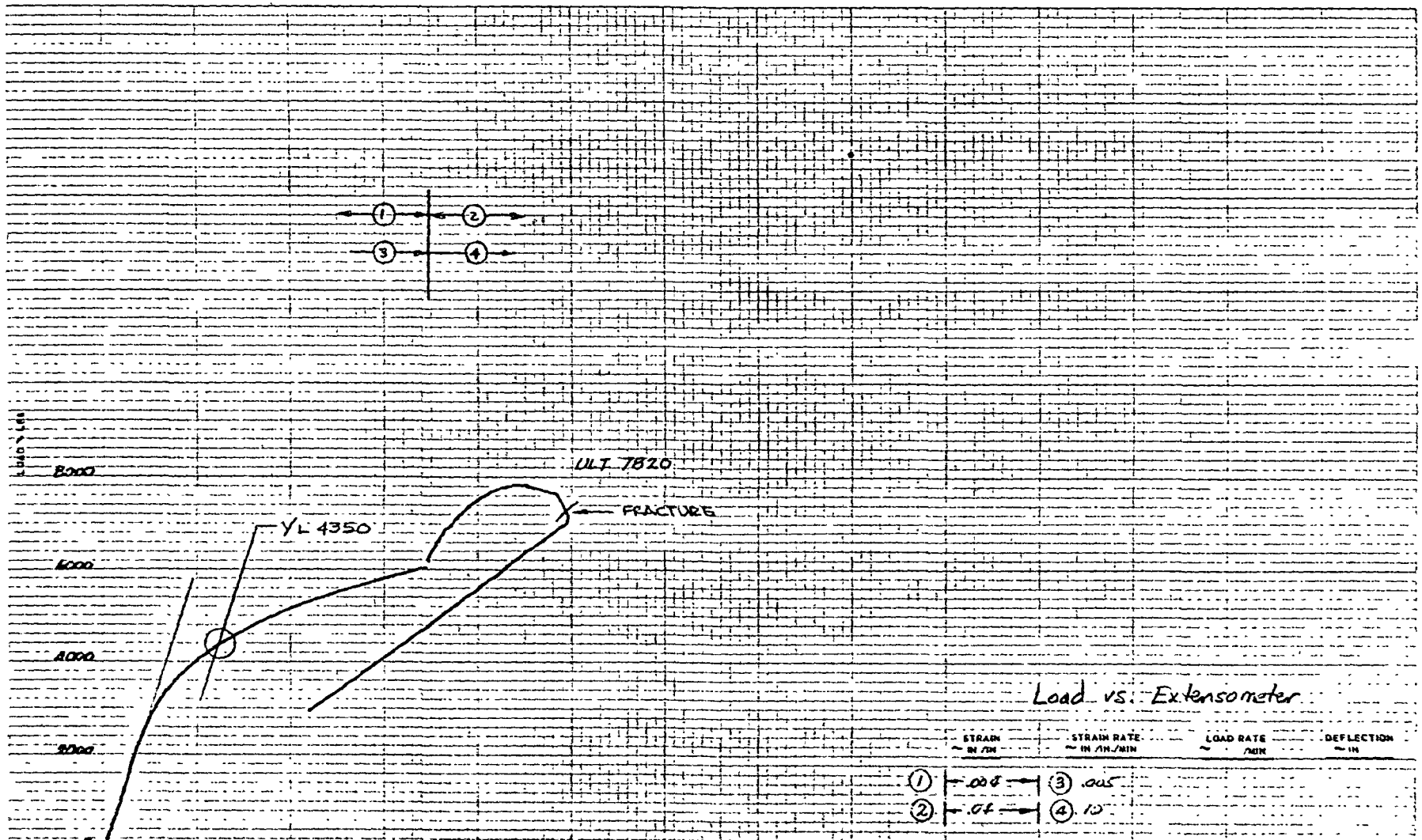


283
for machine only




5000
4000
3000
2000
1000
0
LOAD LB
ULT 4120
ULT 4530
Load Vs. Axial Strain Gage
STRAIN
STRAIN RATE
LOAD RATE
.002
GAGE 3K
1-10-5
OFF 3K
1-9-5
CHECK
APPD
BOEING
TPR
PAGE OF


5000
4000
3000
2000
1000
0
ULT 4420
ULT 4530
Load vs. Poisson Strain Gage
STRAIN
STRAIN RATE
.002
Compression
CALC SK
1-10-5
CHECK
OFR SK
1-9-5
APPD
PAGE OF



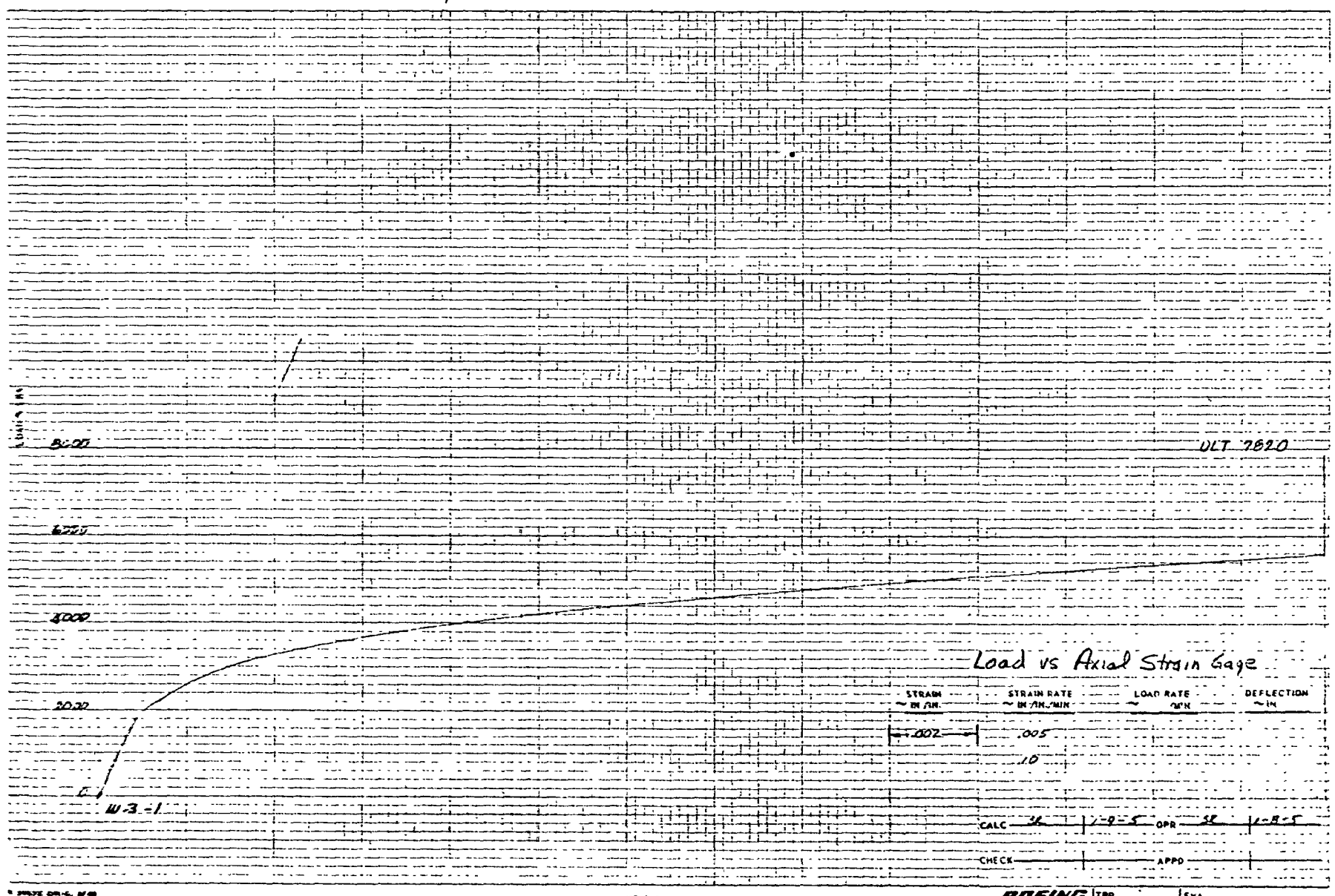
Load vs. Extensometer

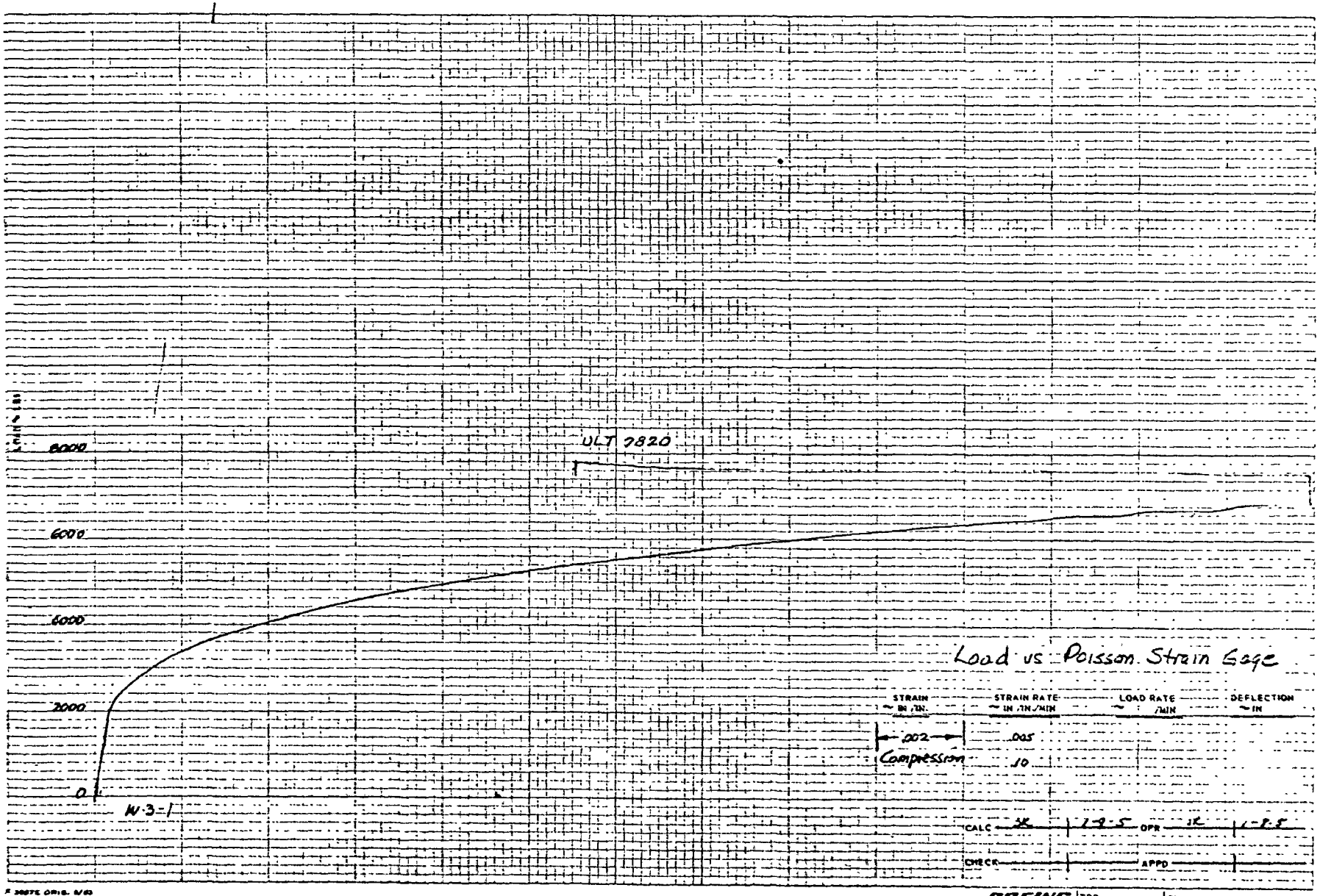
	STRAIN ~ IN /IN	STRAIN RATE ~ IN /IN./MIN	LOAD RATE ~ /MIN	DEFLECTION ~ IN
①	.008	③ .005		
②	.04	④ .10		

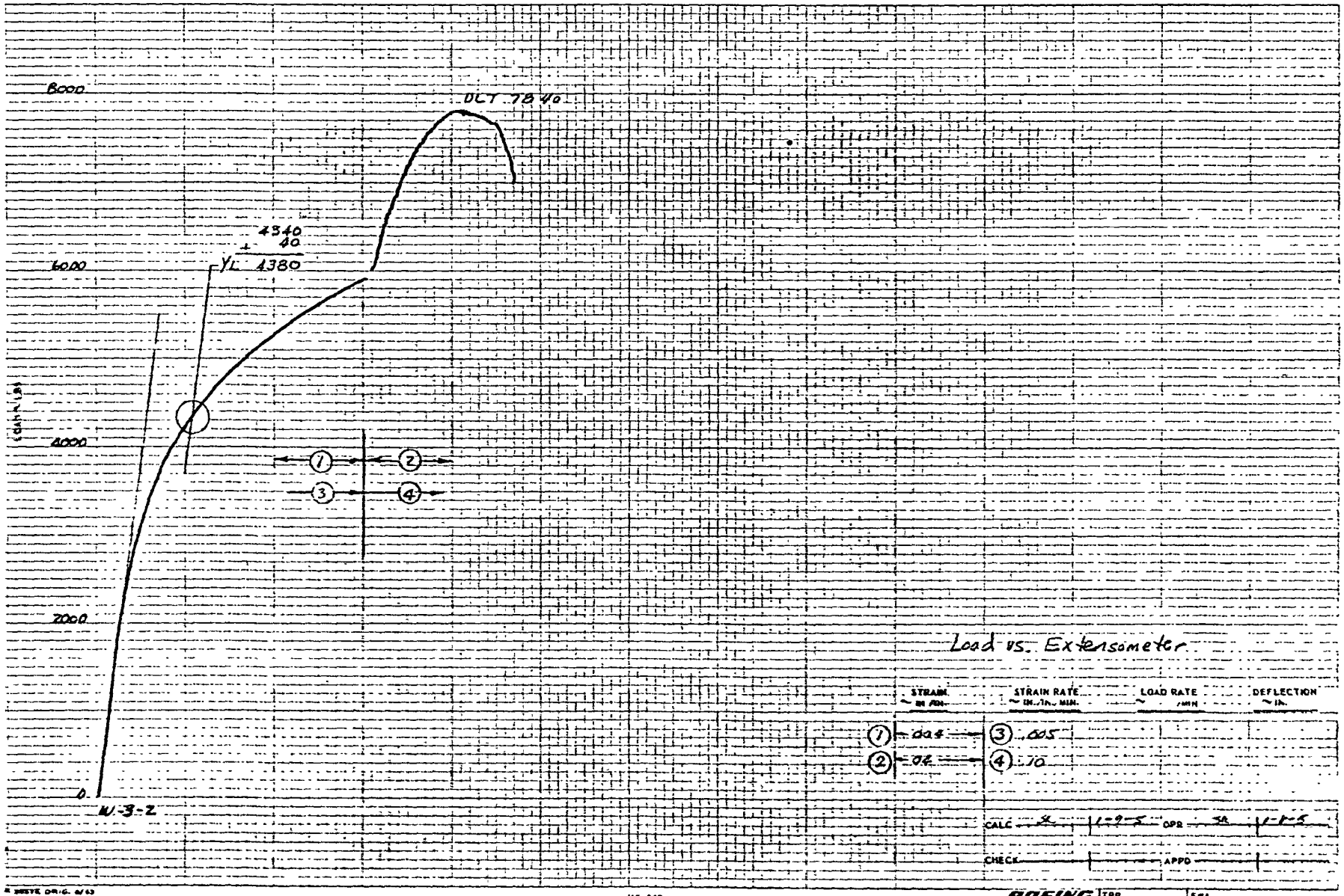
CALC SK 1-9-5 OPR SK 1-8-4

CHECK APPD

BOEING TPR EWA PAGE OF


8000
6000
4000
2000
0
W-3-1
ULT 7820
Load vs Axial Strain Gage
STRAIN ~ IN/IN.
STRAIN RATE ~ IN/IN./MIN
LOAD RATE ~ #/M
DEFLECTION ~ IN
.002
.005
.10
CALC
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF


8000
6000
6000
2000
0
ULT 7820
W-3-1
Load vs Poisson Strain Gage
STRAIN ~ IN./IN.
STRAIN RATE ~ IN./IN./MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
Compression
.005
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF



Load vs. Extensometer

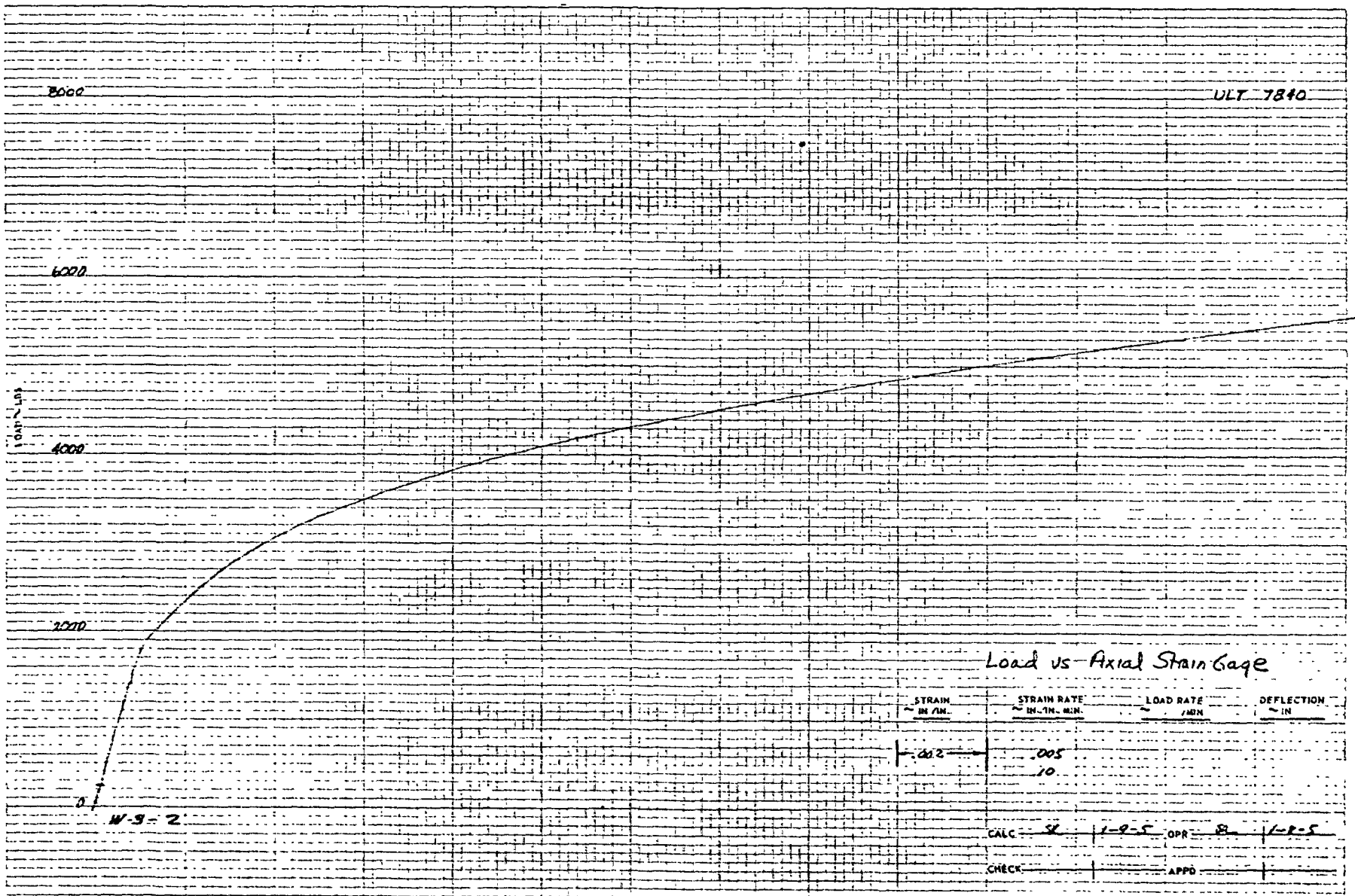
	STRAIN IN./IN.		STRAIN RATE IN./IN./MIN.		LOAD RATE #/MIN		DEFLECTION IN.
1	.004	3	.005				
2	.02	4	.10				

CALC [illegible] 11-9-5 OPR [illegible] 11-1-5

CHECK APPD

BOEING TPR EWA PAGE OF

J15-047



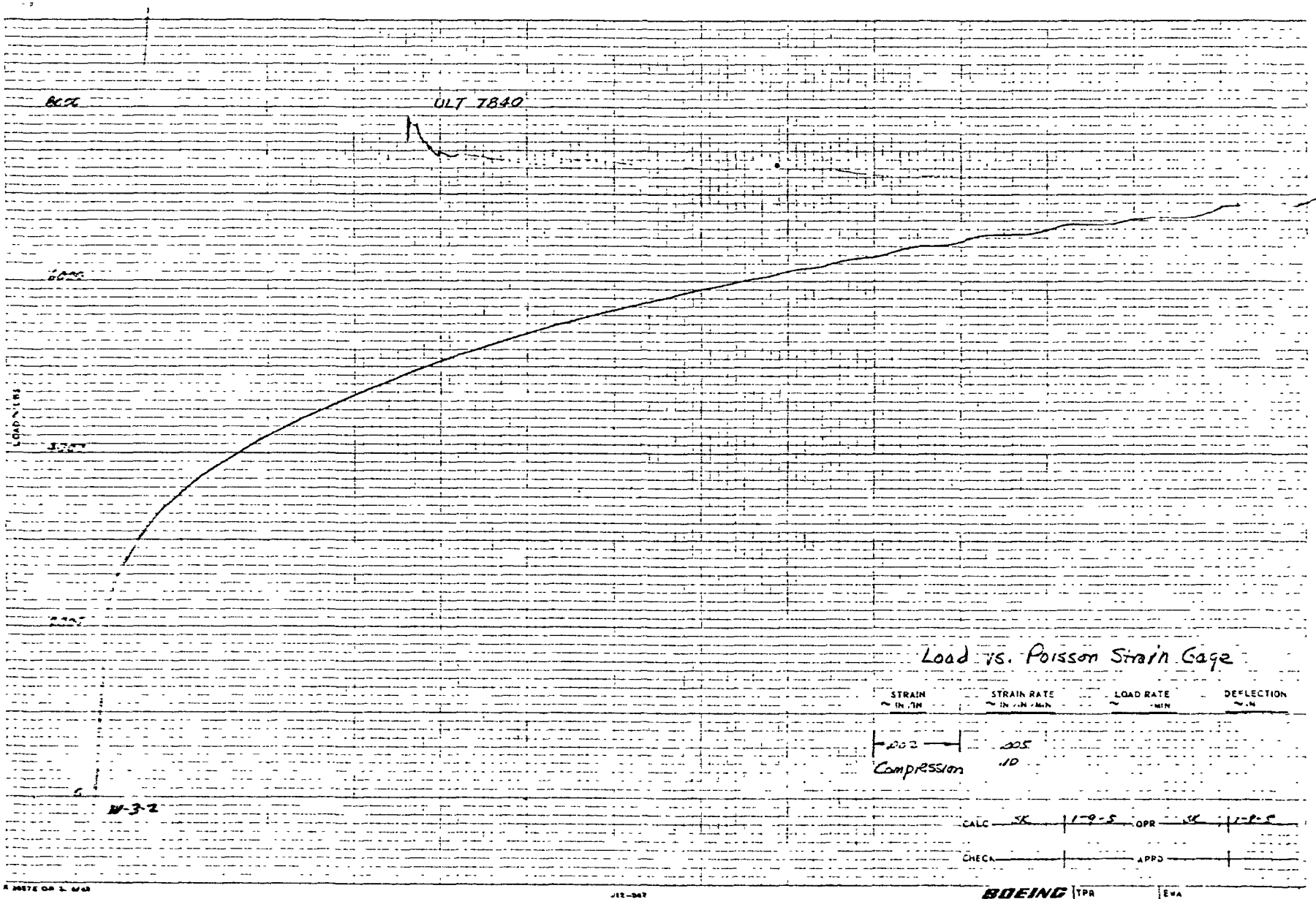
Load vs Axial Strain Gage

STRAIN ~ IN/IN	STRAIN RATE ~ IN-IN-MIN	LOAD RATE ~ /MIN	DEFLECTION ~ IN
.002	.005 .10		

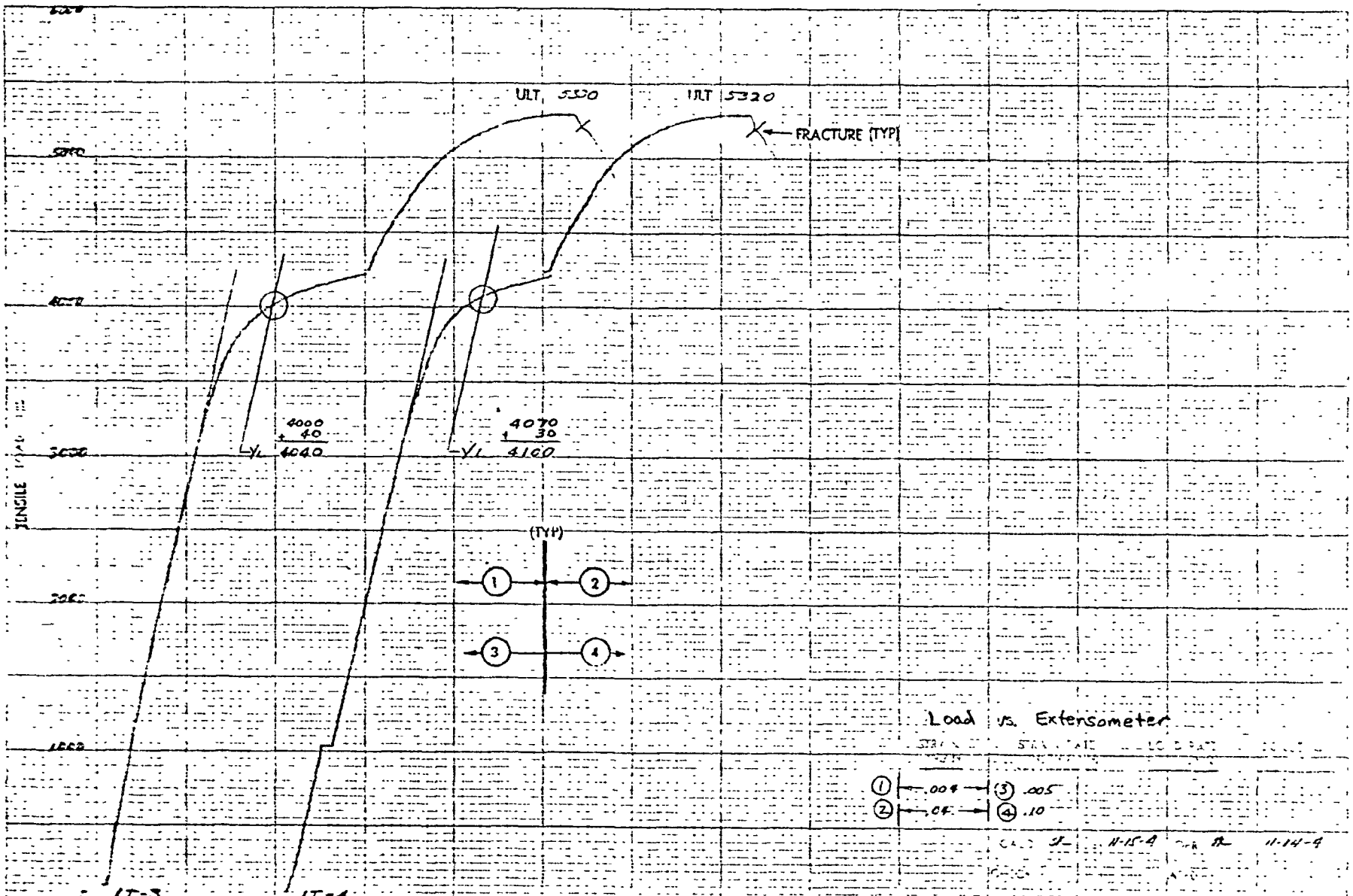
CALC SK 1-9-5 OPR [illegible] 1-9-5

CHECK APPD

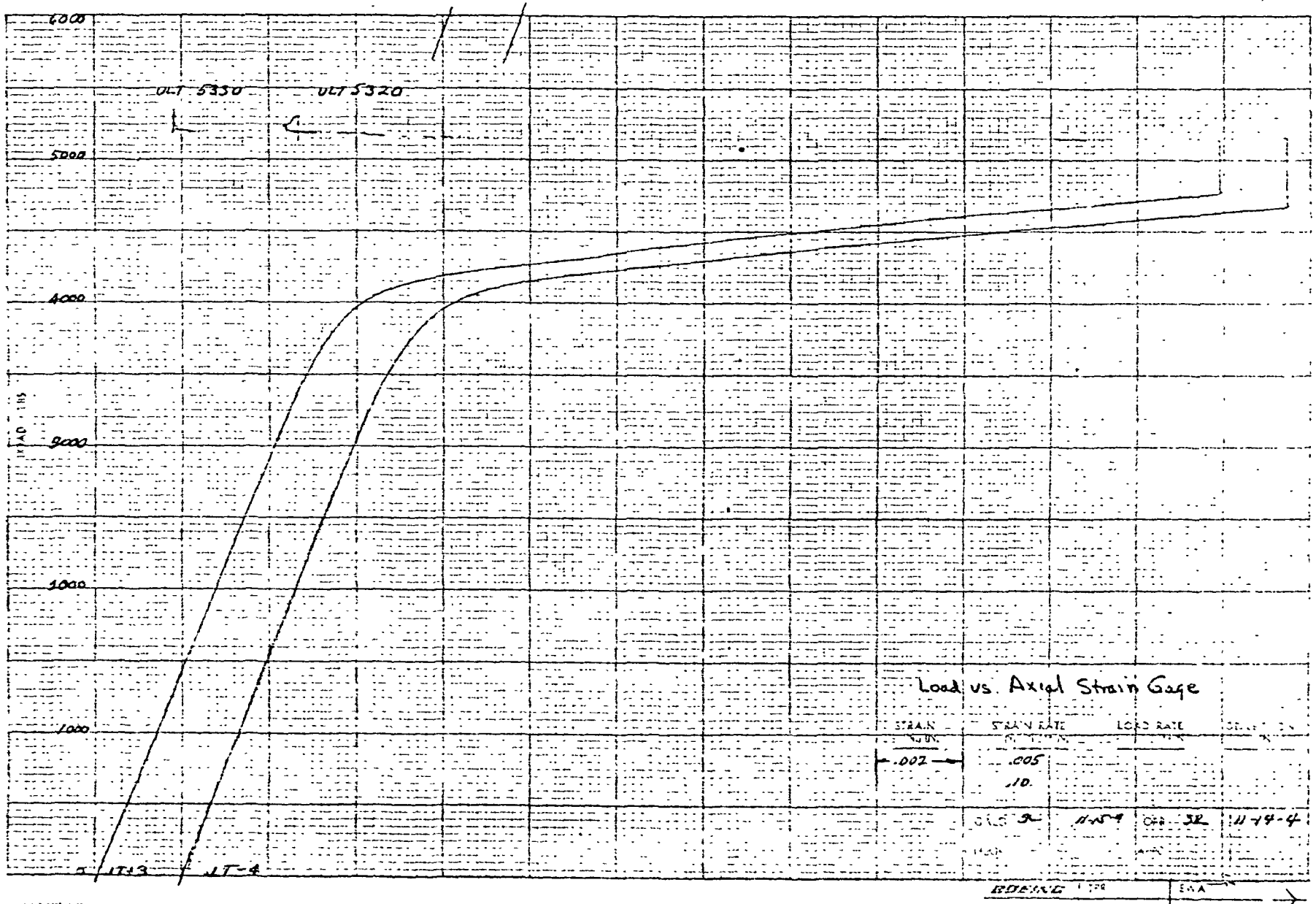
BOEING TPR TEA PAGE OP


ULT 7840
LOAD LBS
W-3-2
Load vs. Poisson Strain Gage
STRAIN IN/IN
STRAIN RATE IN/IN/MIN
LOAD RATE LBS/MIN
DEFLECTION IN
.002
Compression
.005
.10
CALC SK 1-9-5
OPR SK 1-9-5
CHECK
APPD
BOEING
TPR
EWA
PAGE OF

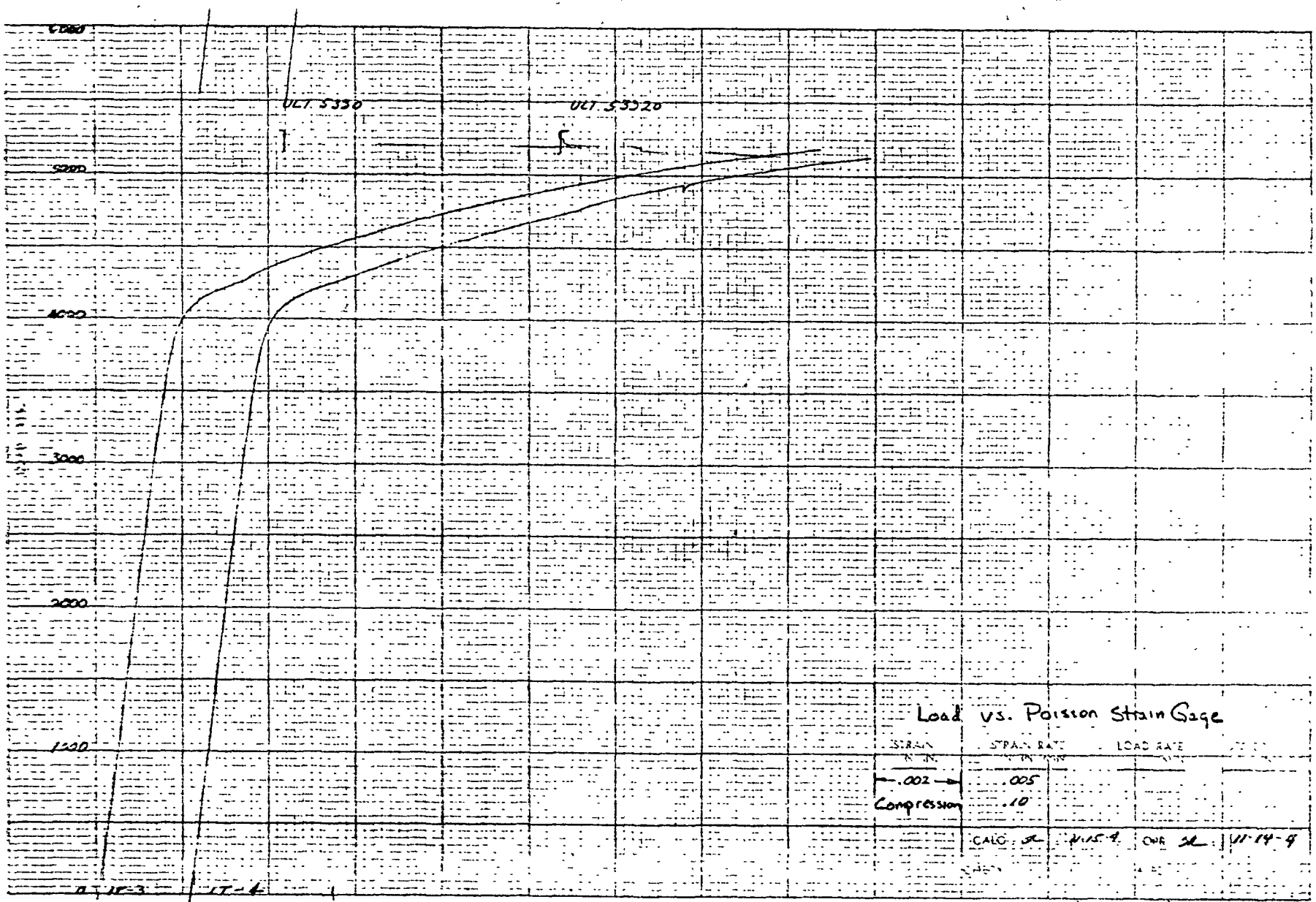
For machine only

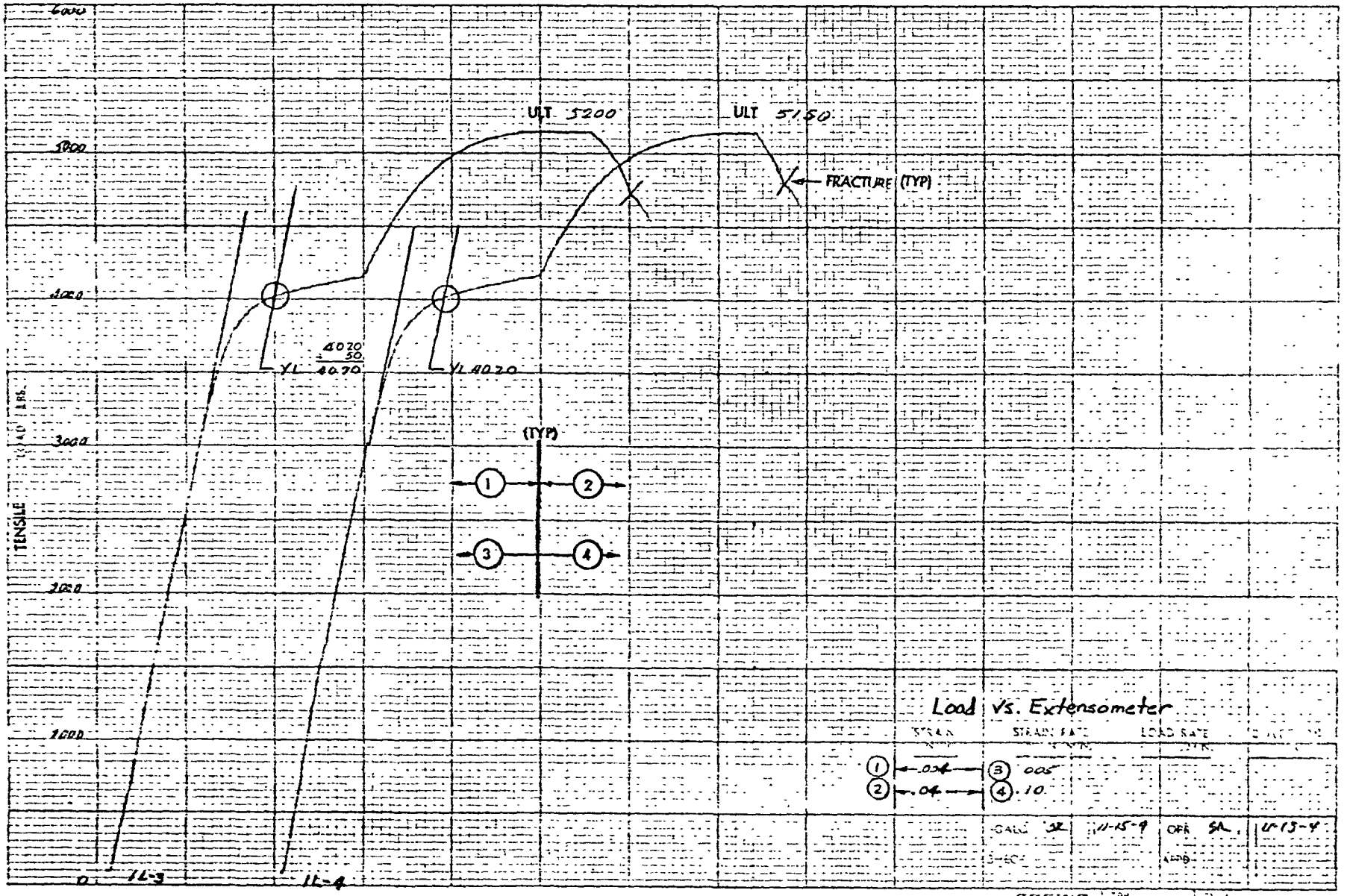


for machine only



294
for machine only



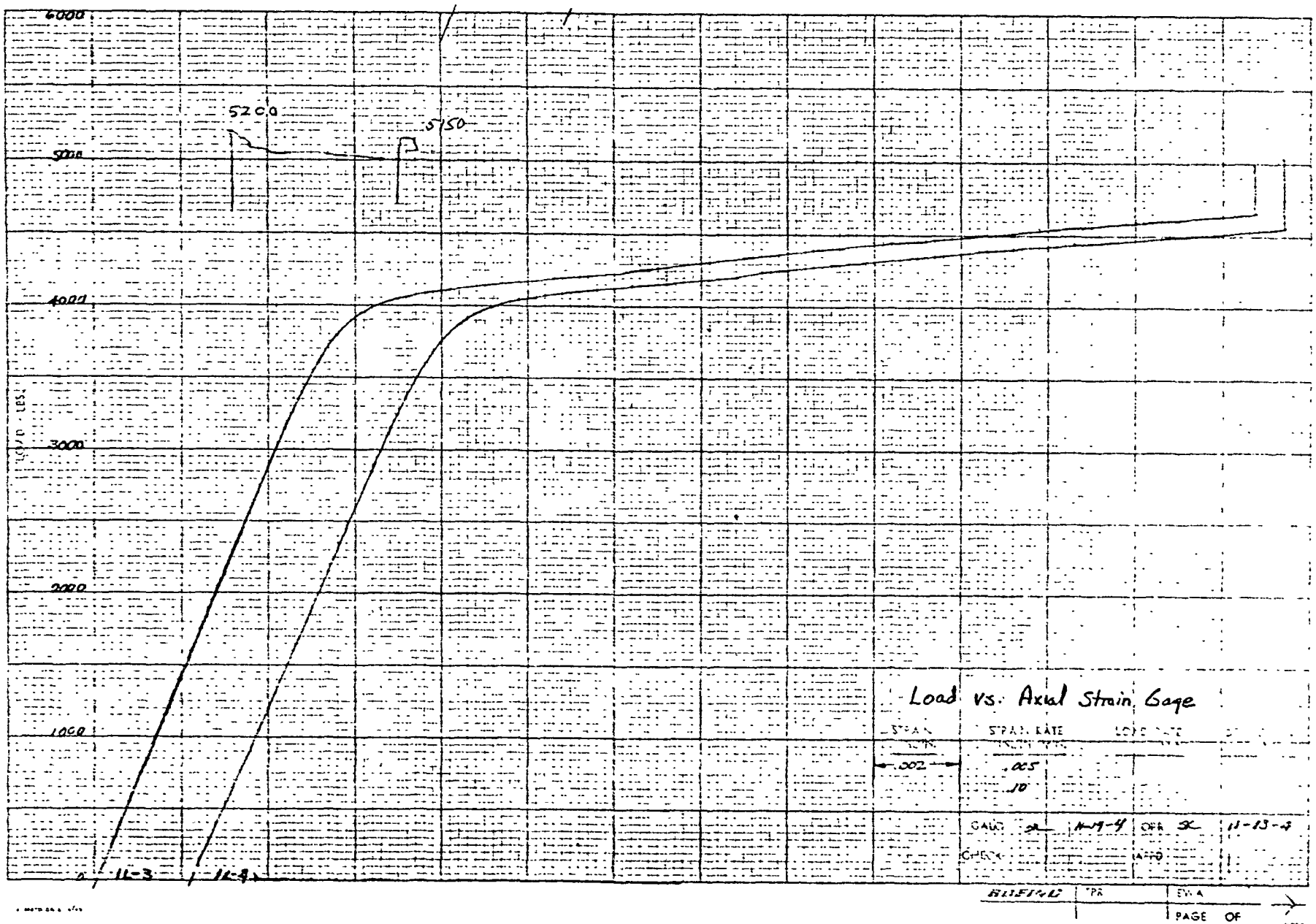


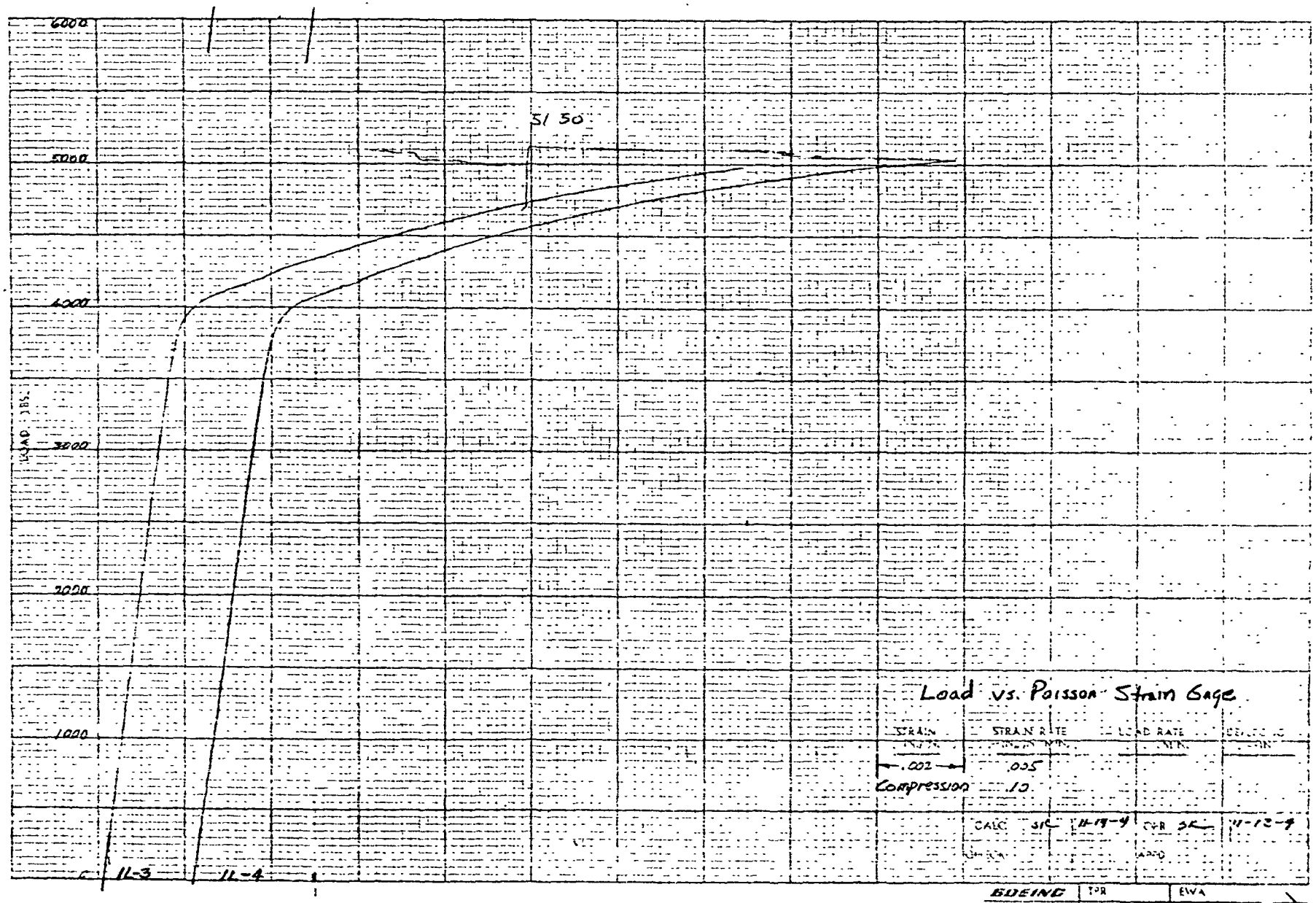
295

for machine only

962

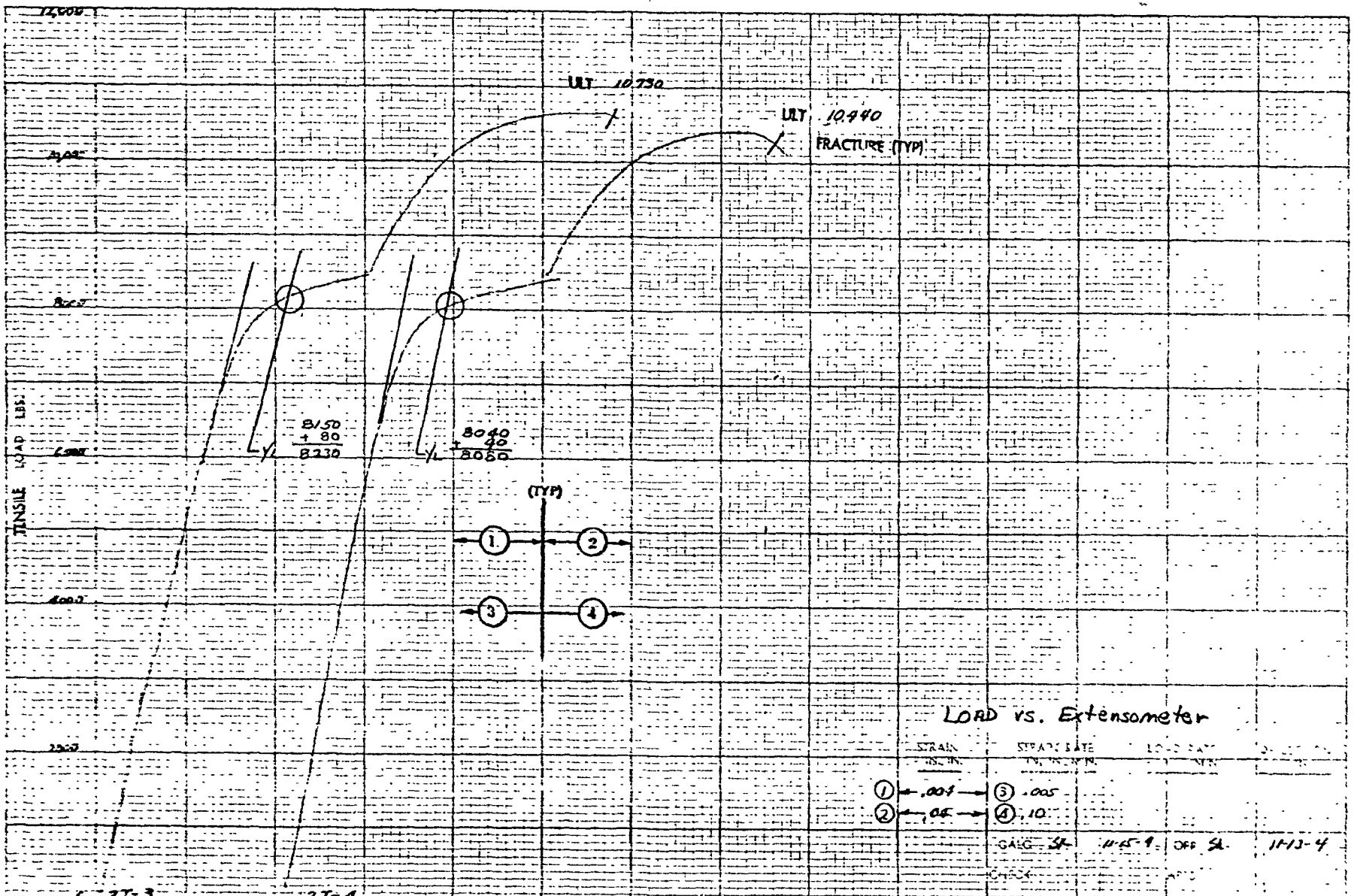
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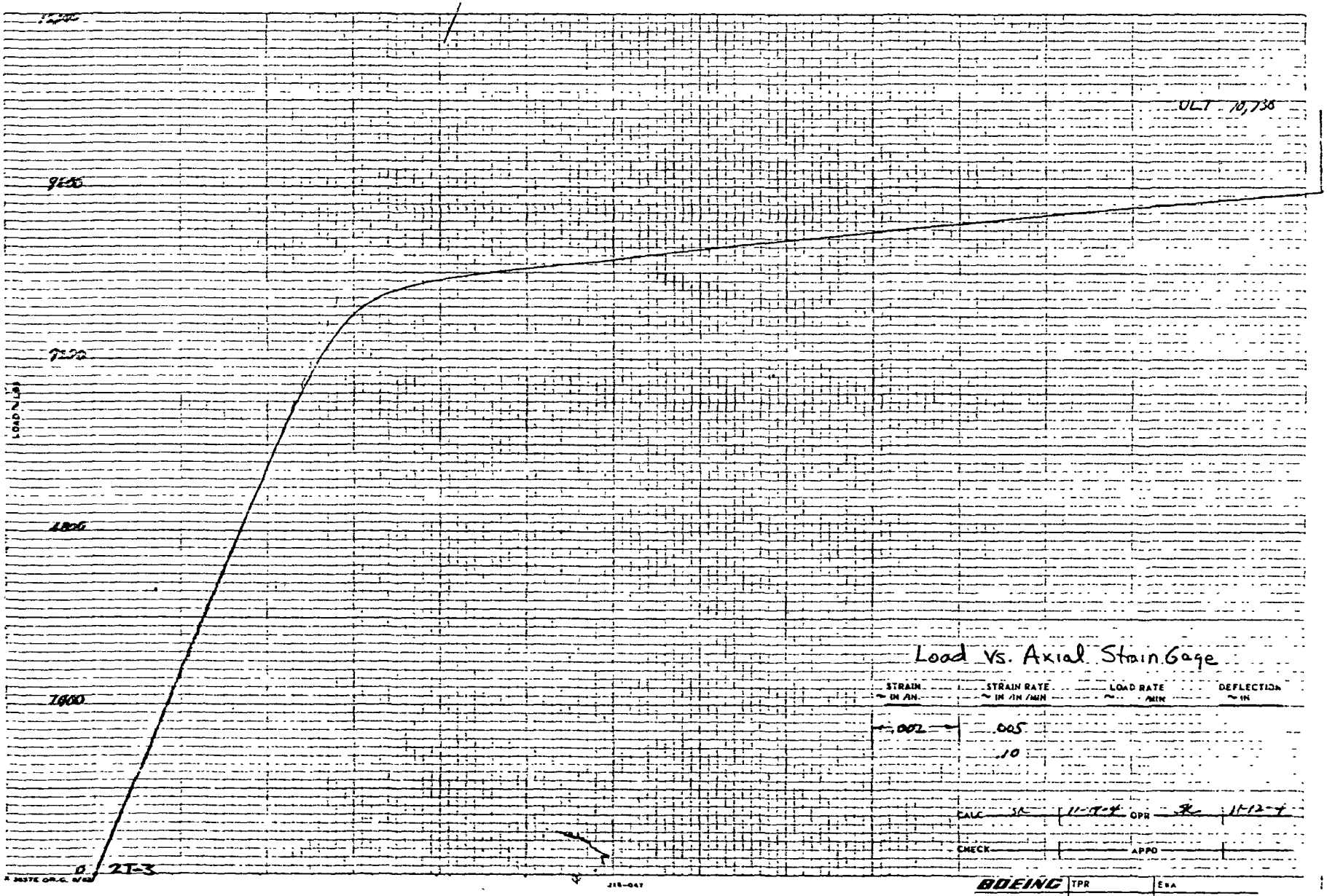


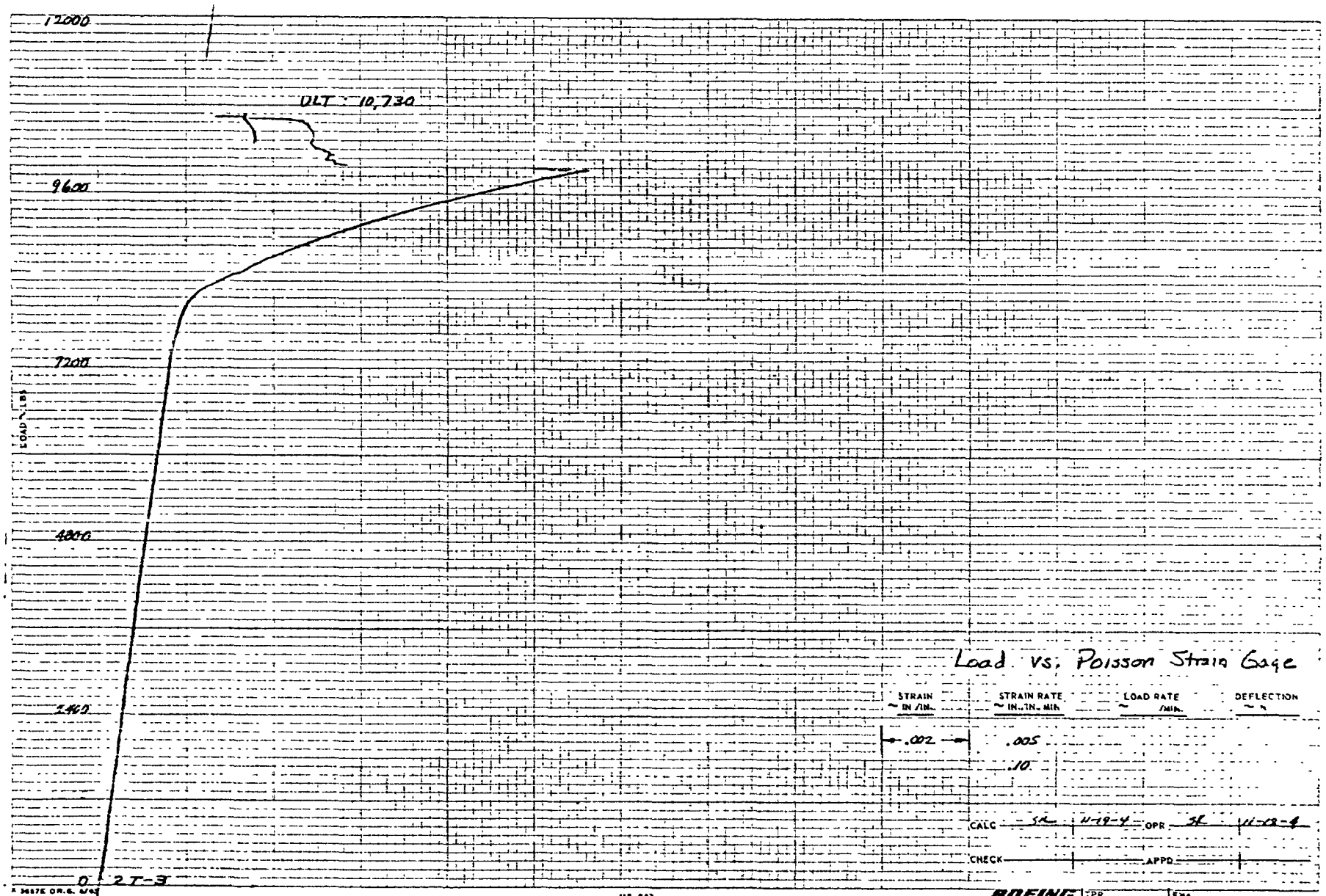


297
for machine only

862
for machine only




ULT 10,736
9600
7200
4800
2400
0
LOAD (LB)
2T-3
Load Vs. Axial Strain Gage
STRAIN ~ IN/IN
STRAIN RATE ~ IN/IN/MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
ENG
PAGE OF



Load vs. Poisson Strain Gage

STRAIN ~ IN/IN.	STRAIN RATE ~ IN./IN./MIN.	LOAD RATE ~ /MIN.	DEFLECTION ~ "
.002	.005		
	.10		

CALC SR 11-19-4 OPR SR 11-20-4

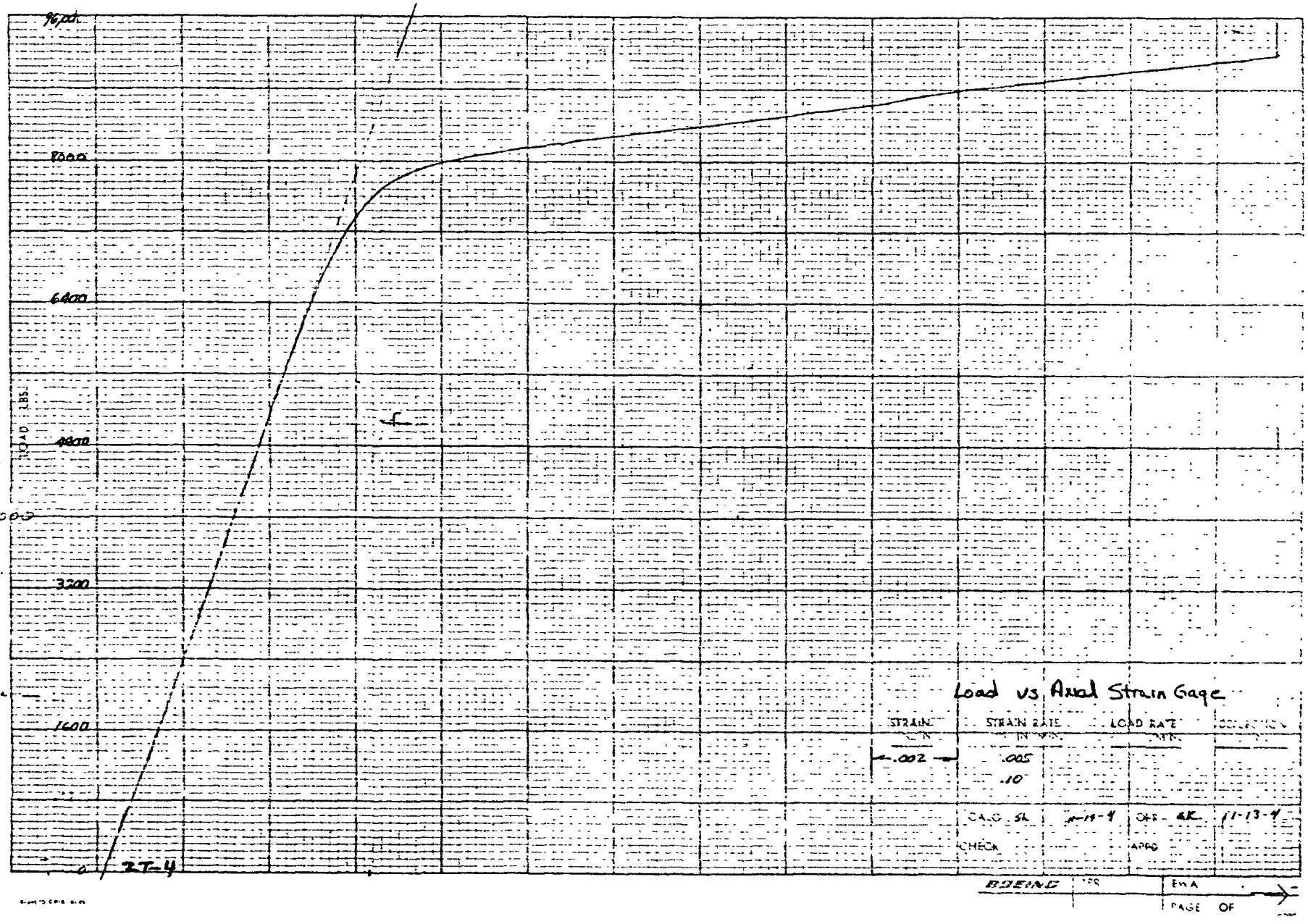
CHECK APPD

BOEING | PR | EWA | PAGE OF

J18-647

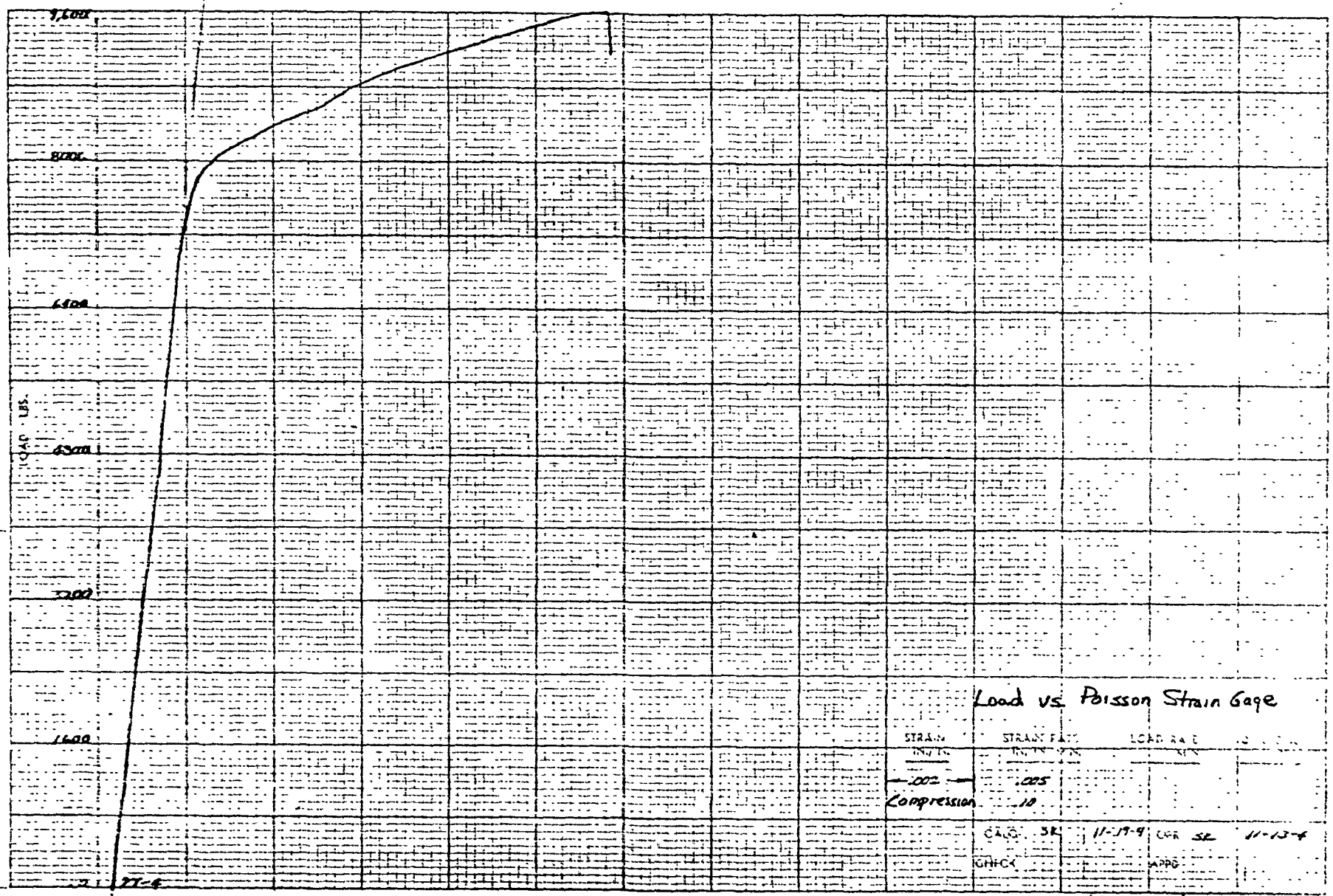
47 0/03

300



10C

For machine only



Load vs. Poisson Strain Gage

STRAIN IN/IN	STRAIN RATE IN/IN/MIN	LOAD RATE LBS/MIN
.002	.005	
Compression	.10	

CALC. SR 11-19-9 CHK SR 11-13-4

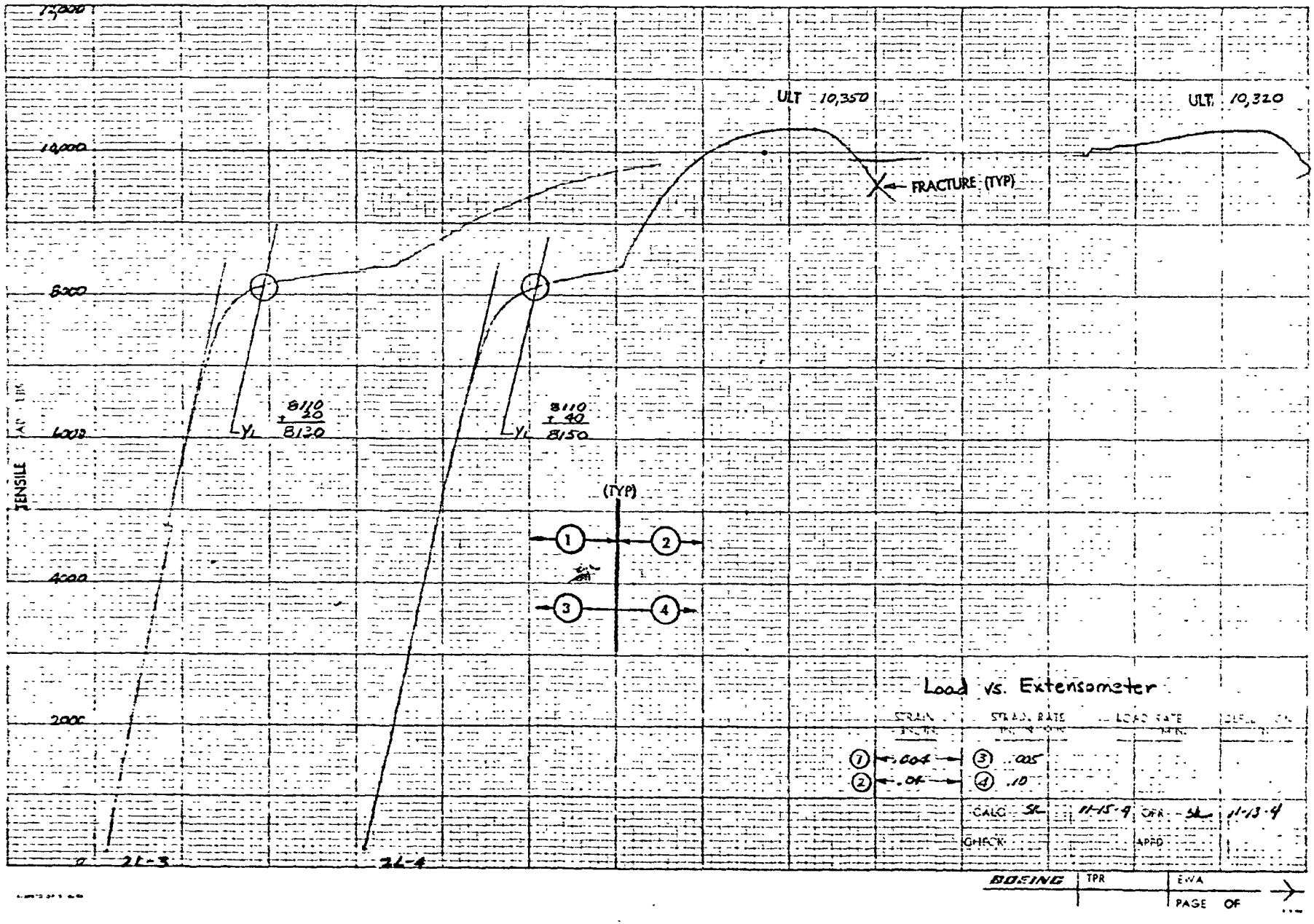
CHECK APPD

BOEING | TPR | EWA

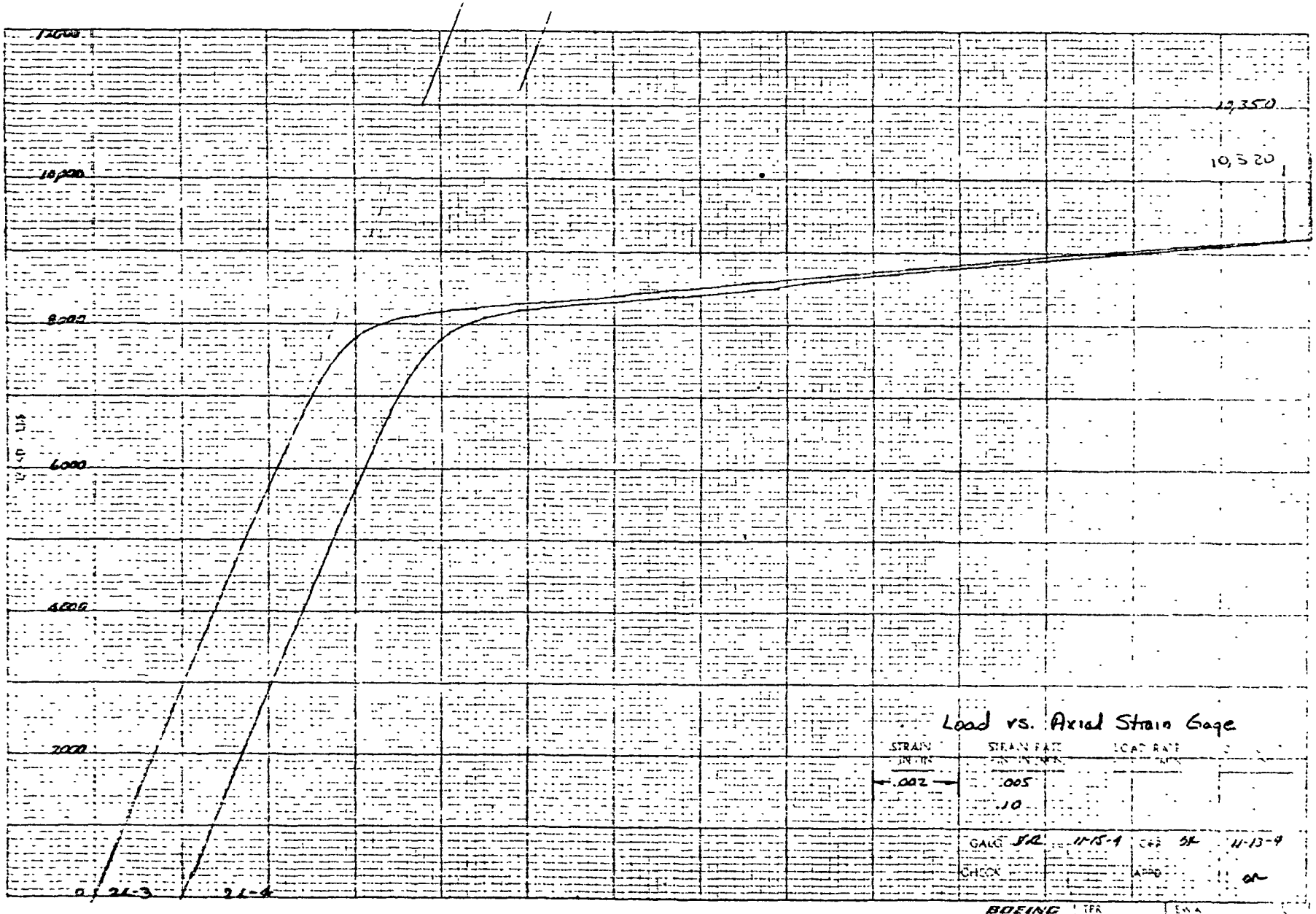
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302

for machine only

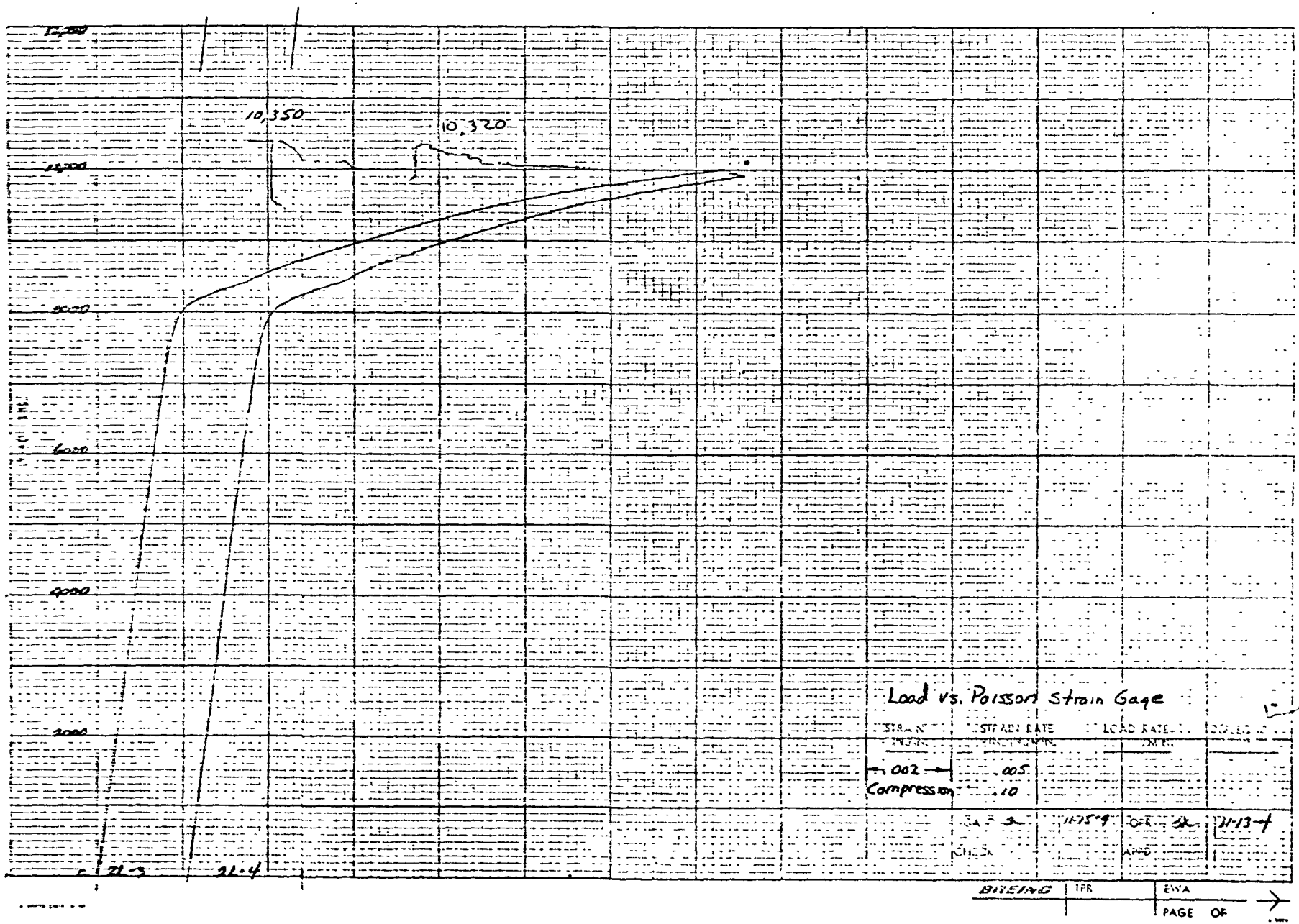


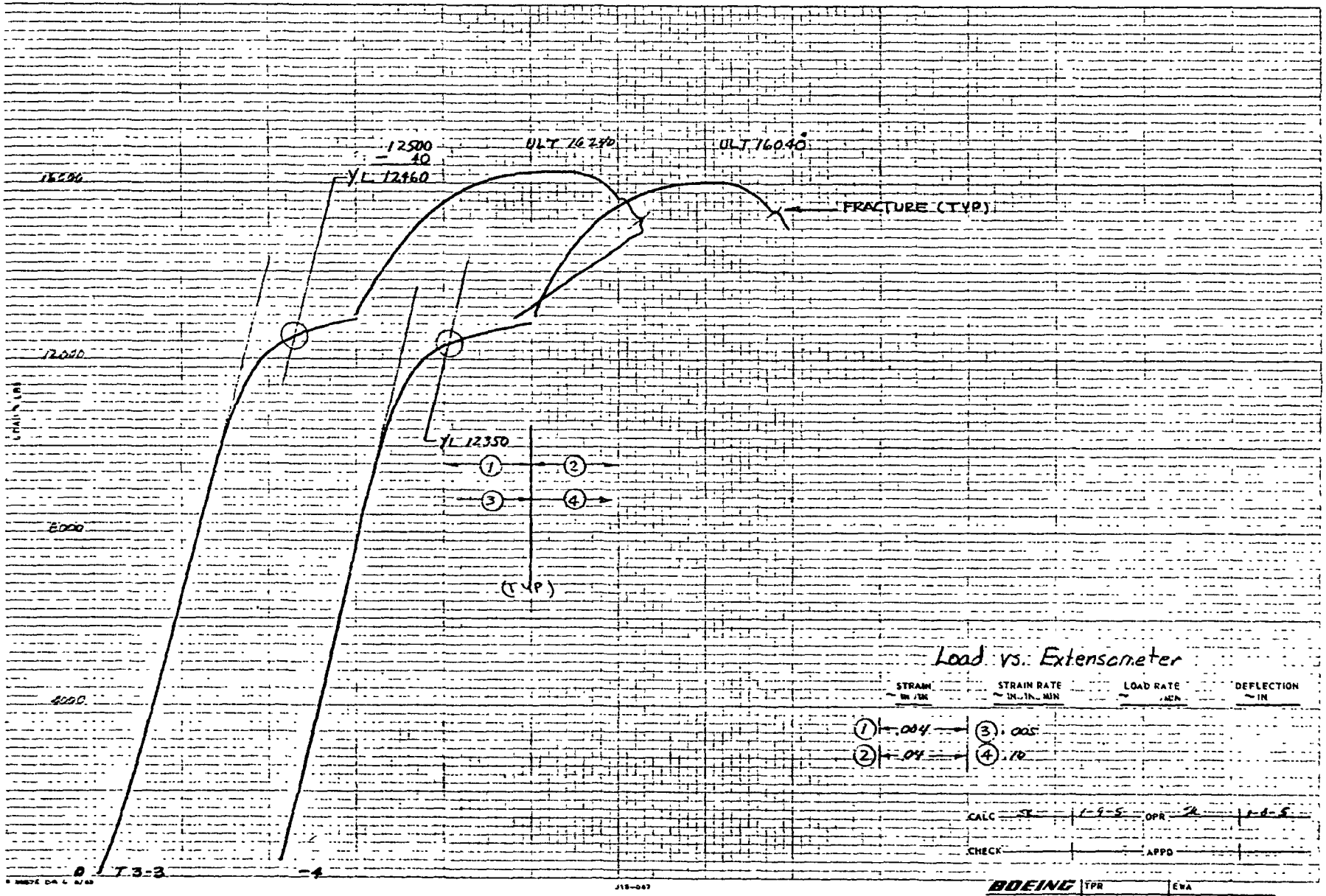
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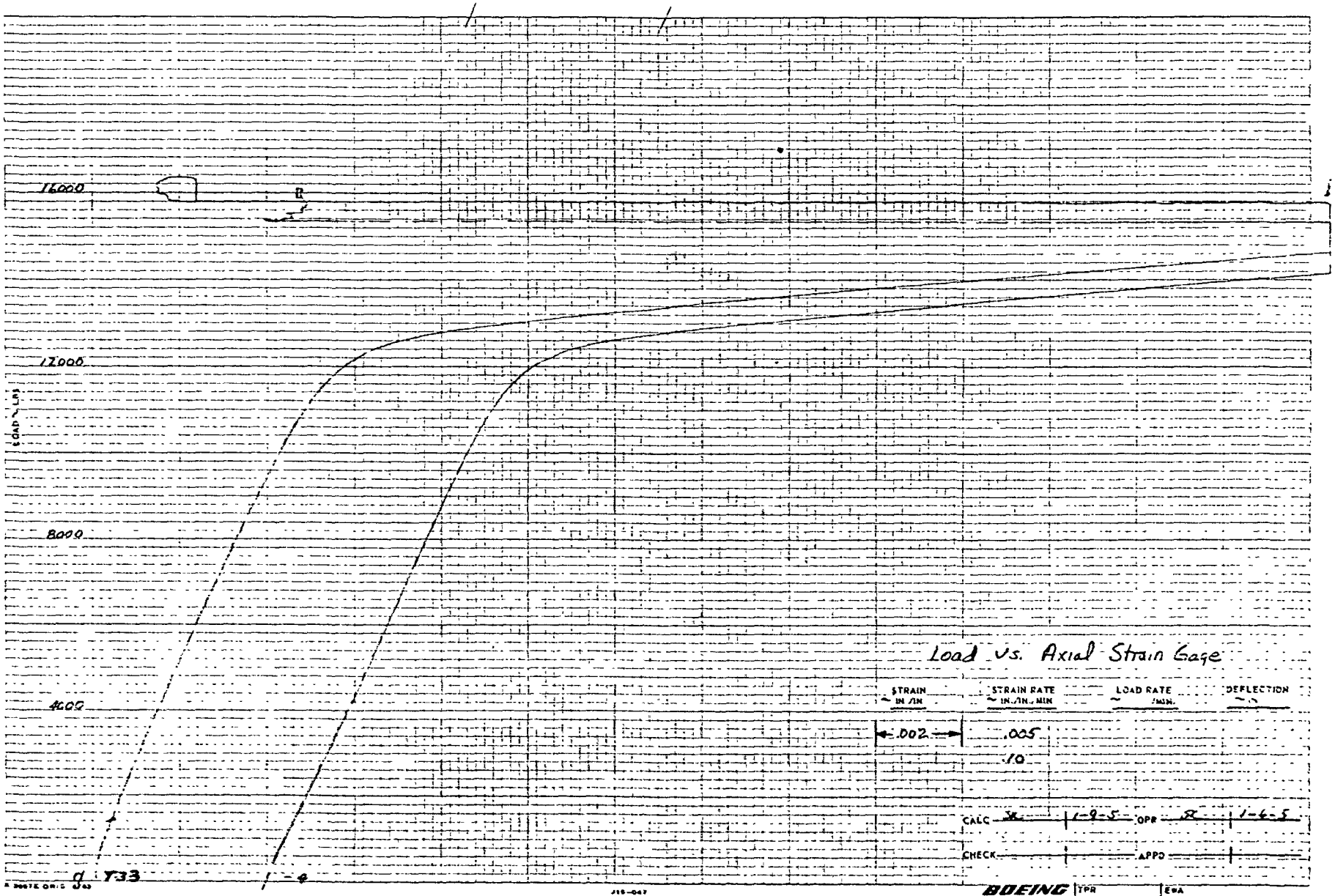


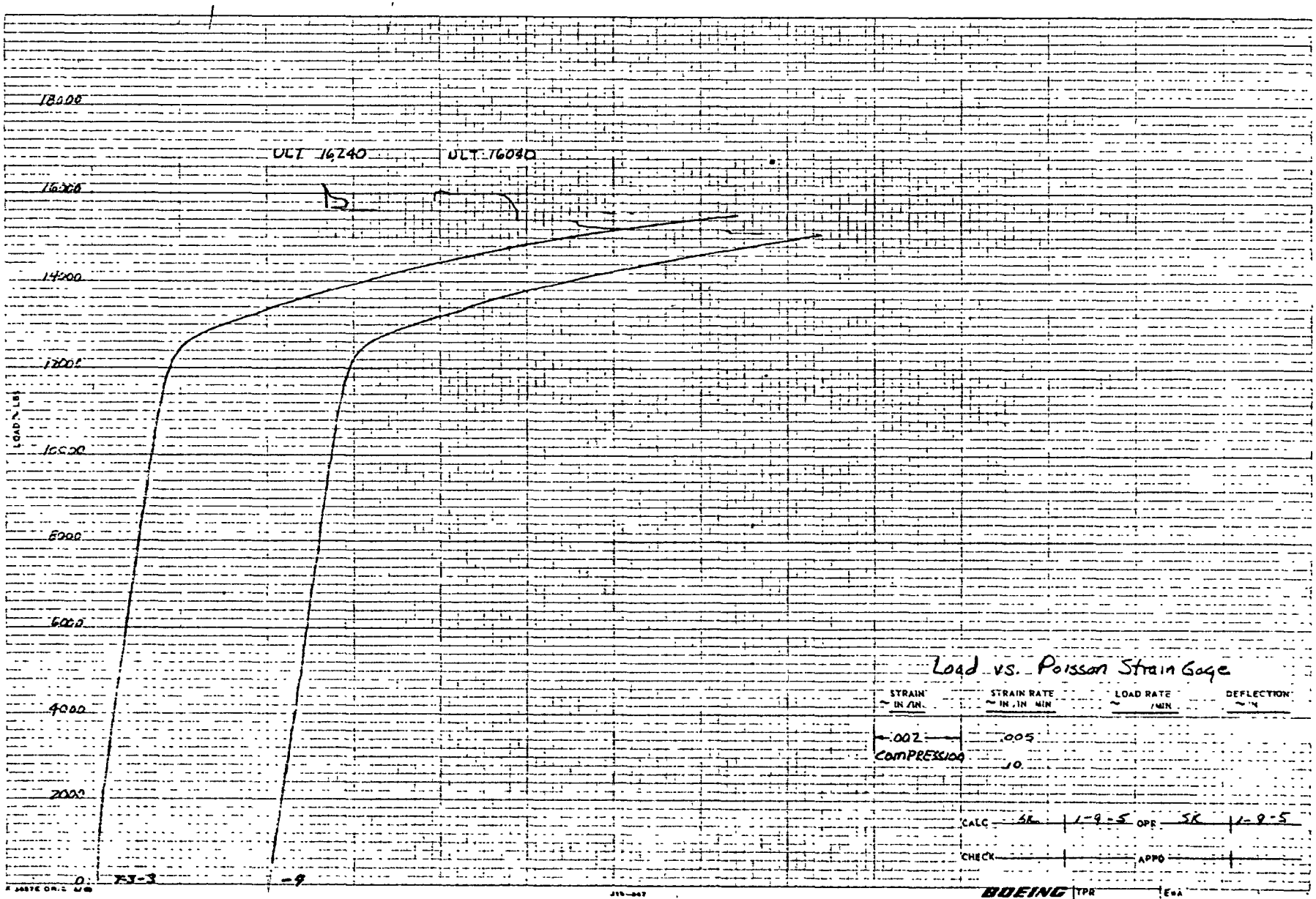
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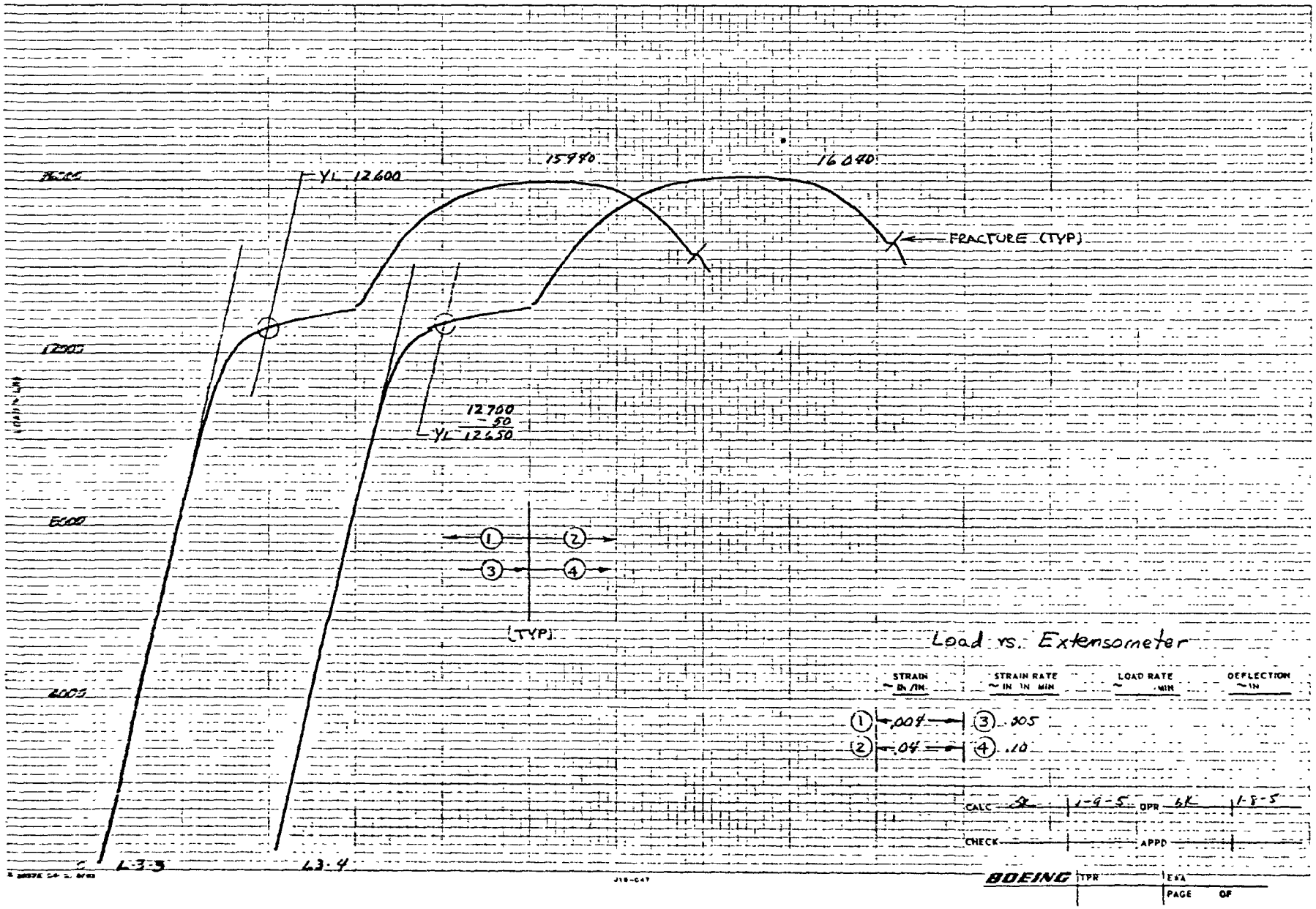
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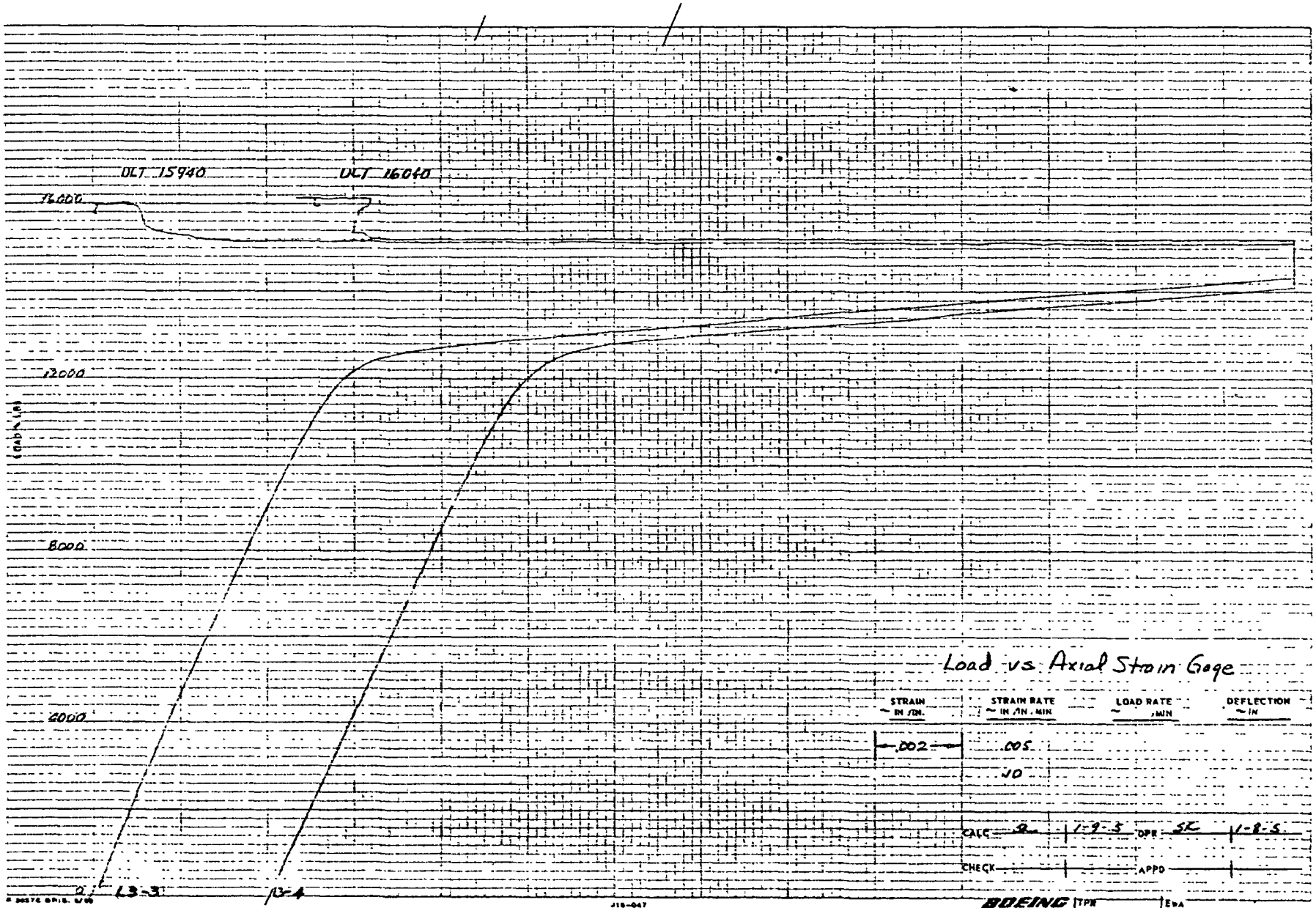

10,350
10,320
6000
4000
2000
Load vs. Poisson Strain Gage
.002
Compression
.005
.10
11-13-4
BEEING
TPR
EWA
PAGE OF

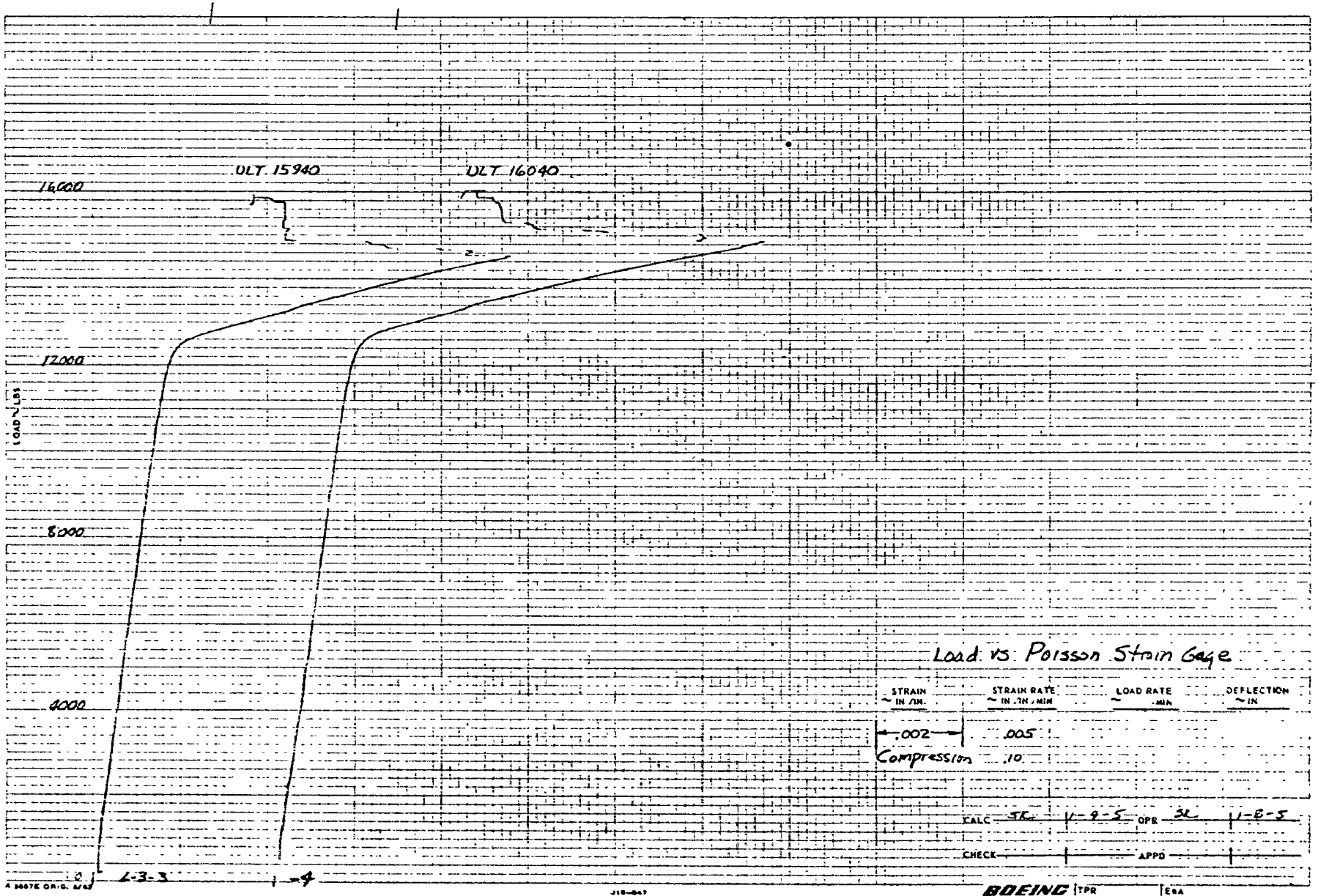

12500
40
YL 12460
ULT 16270
ULT 16040
FRACTURE (TYP.)
16000
12000
8000
4000
LOAD, LBS
YL 12350
(TYP)
Load vs. Extensometer
STRAIN IN/IN
STRAIN RATE IN./IN./MIN
LOAD RATE LBS/MIN
DEFLECTION IN
① .004 → ③ .005
② .04 → ④ .10
CALC
OPR
CHECK
APPD
BOEING
TPR
EWA
PAGE
OF
T3-3
-4


16000
12000
8000
4000
LOAD (LBS)
Load vs. Axial Strain Gage
STRAIN IN/IN
STRAIN RATE IN./IN./MIN
LOAD RATE /MIN.
DEFLECTION
.002
.005
.10
CALC
1-9-5
OPR
1-6-5
CHECK
APPD
BOEING
TPR
EGA
PAGE
OF

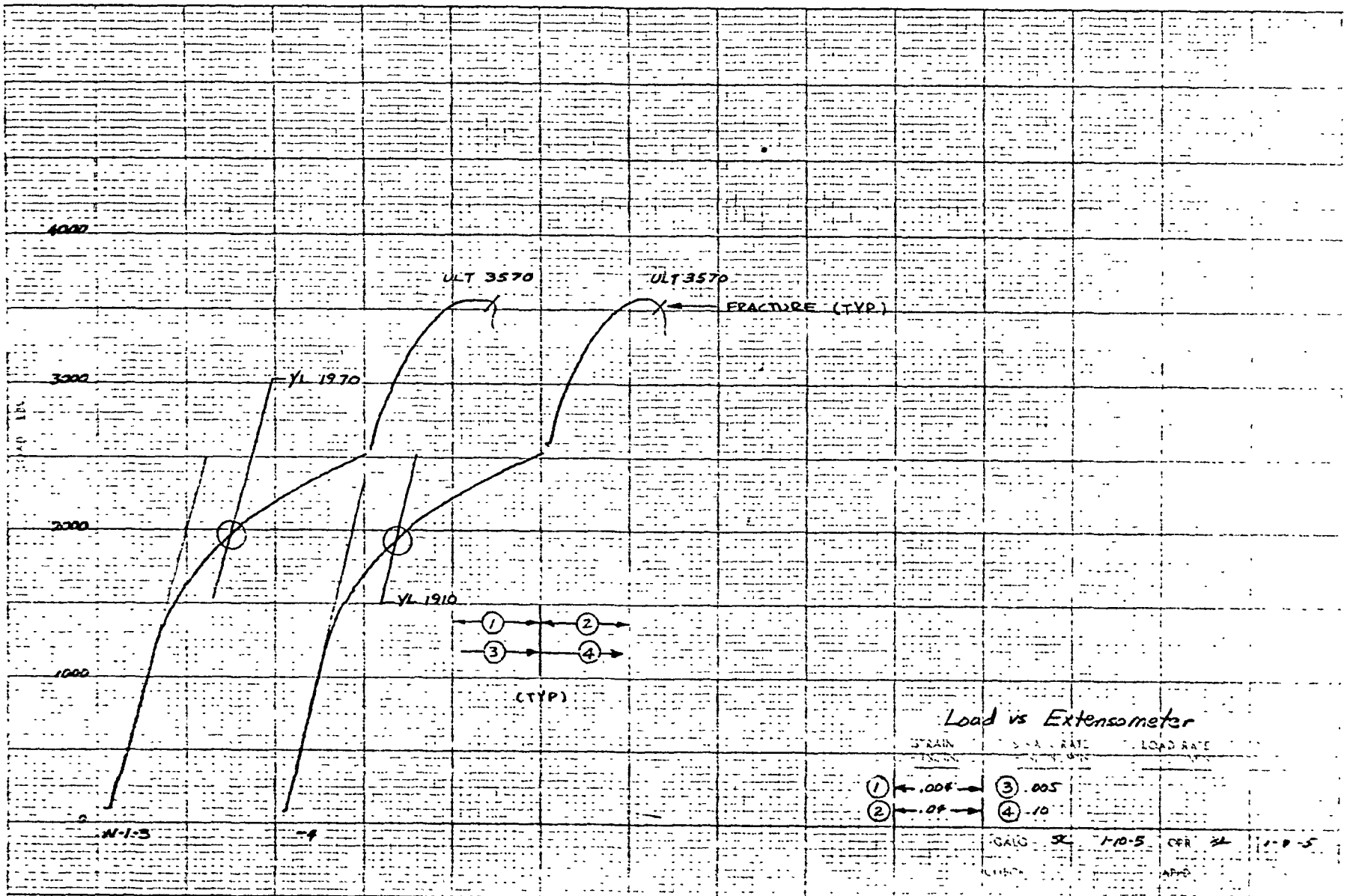

18000
16000
14000
12000
10000
8000
6000
4000
2000
0
LOAD - LBS
ULT 16240
ULT 16090
EJ-3
-9
Load vs. Poisson Strain Gage
STRAIN ~ IN/IN.
STRAIN RATE ~ IN/IN MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
COMPRESSION
.005
.10
CALC SR 1-9-5
OPR SR 1-9-5
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF


15980
16040
YL 12600
FRACTURE (TYP)
12700
50
YL 12650
(TYP)
Load vs. Extensometer
STRAIN ~ IN /IN
STRAIN RATE ~ IN IN MIN
LOAD RATE ~ MIN
DEFLECTION ~ IN
1 .004 3 .05
2 .04 4 .10
CALC 1-9-5 OPR 1-8-5
CHECK APPD
BOEING TPR ENG
PAGE OF
L3-3
L3-4

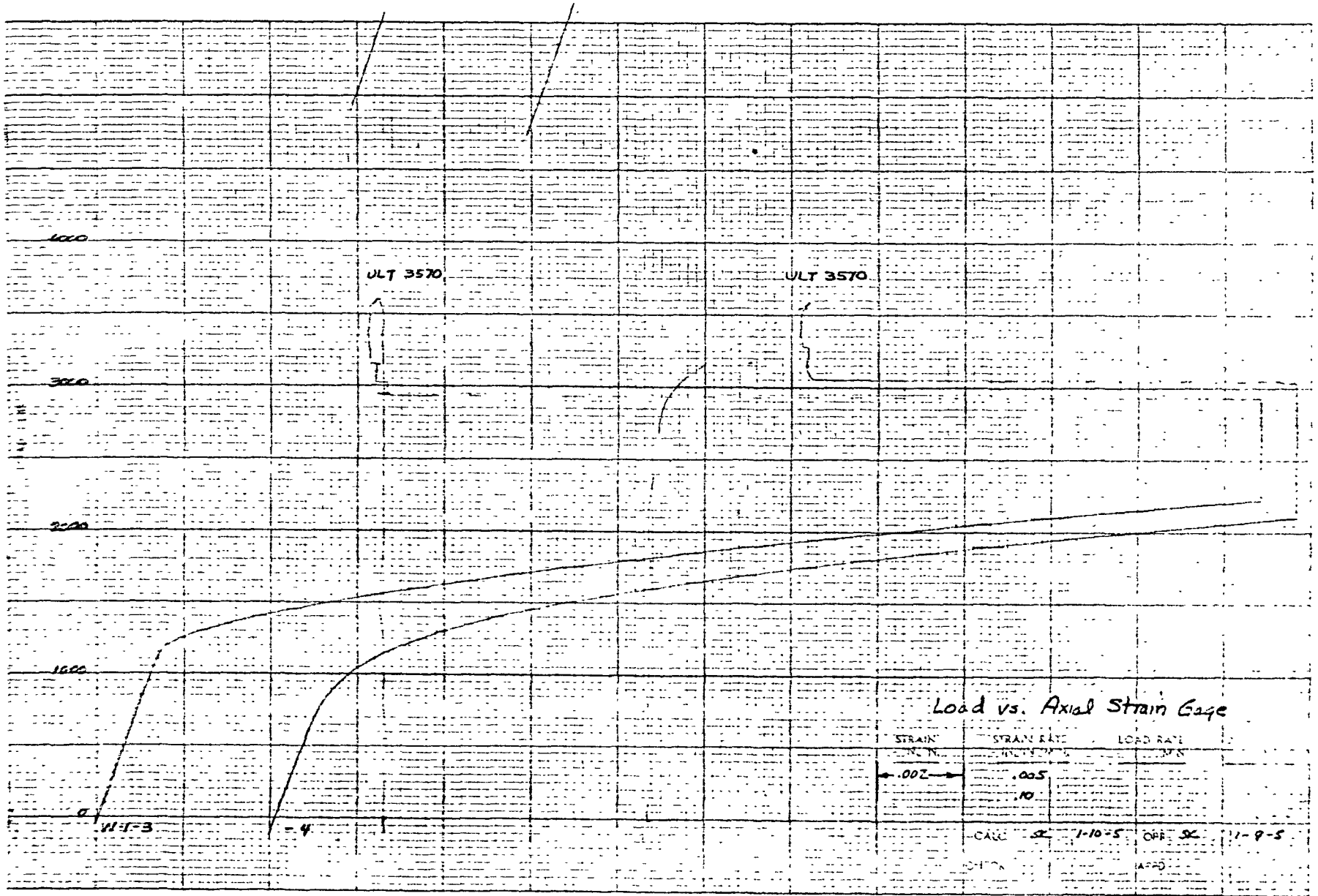

ULT 15940
ULT 16040
16000
12000
8000
4000
0
(LOAD, LB)
L3-3
L3-4
Load vs Axial Strain Gage
STRAIN ~ IN/IN.
STRAIN RATE ~ IN/IN. MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
.10
CALC
DPR
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF

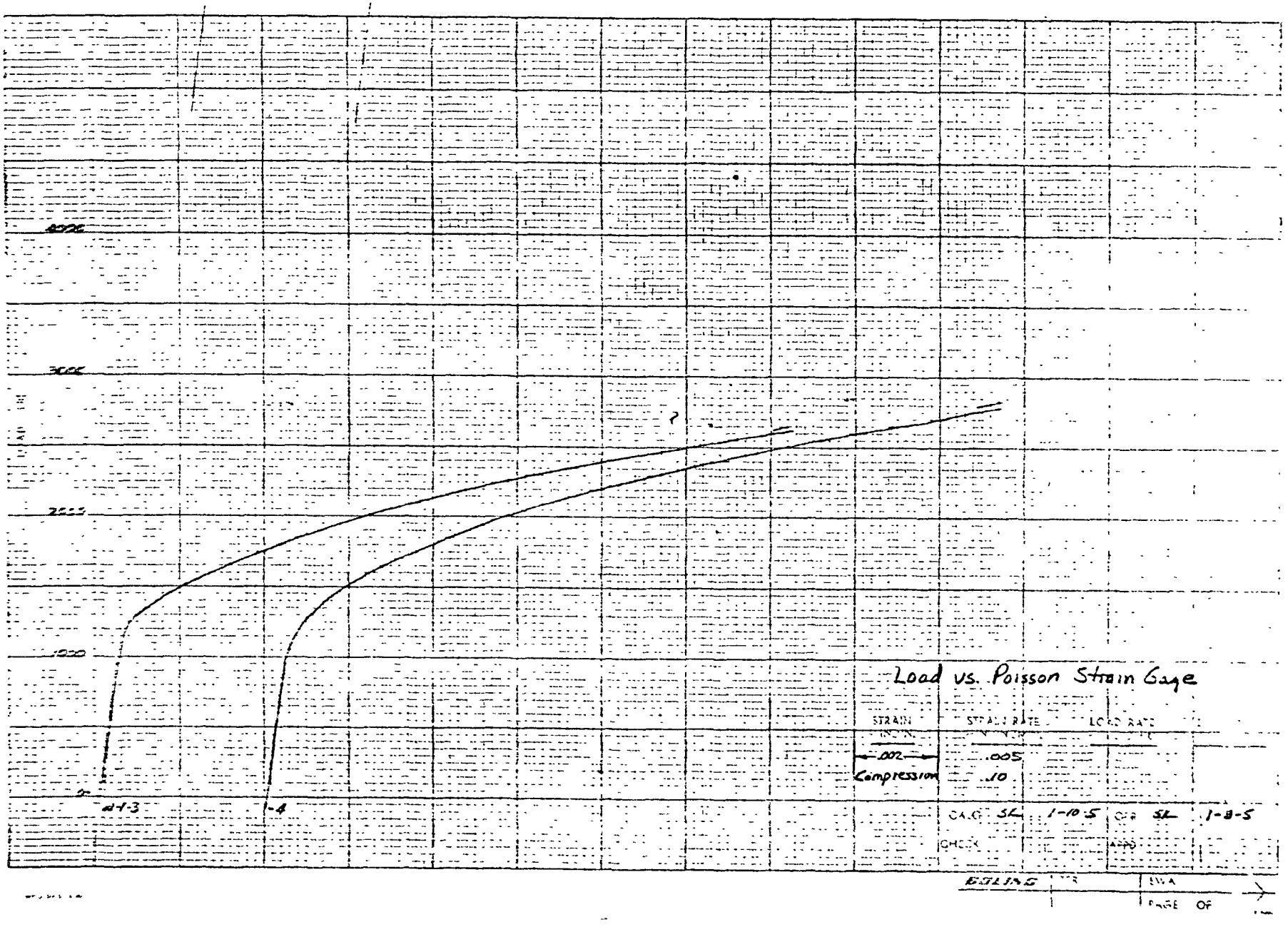

ULT 15940
ULT 16040
16000
12000
8000
4000
LOAD ~ LBS
0
1-3-3
-4
Load vs. Poisson Strain Gage
STRAIN ~ IN /IN.
STRAIN RATE ~ IN /IN / MIN
LOAD RATE ~ /MIN
DEFLECTION ~ IN
.002
.005
Compression
.10
CALC
OPR
CHECK
APPD
BOEING
TPR
ENG
PAGE
OF

for machine only

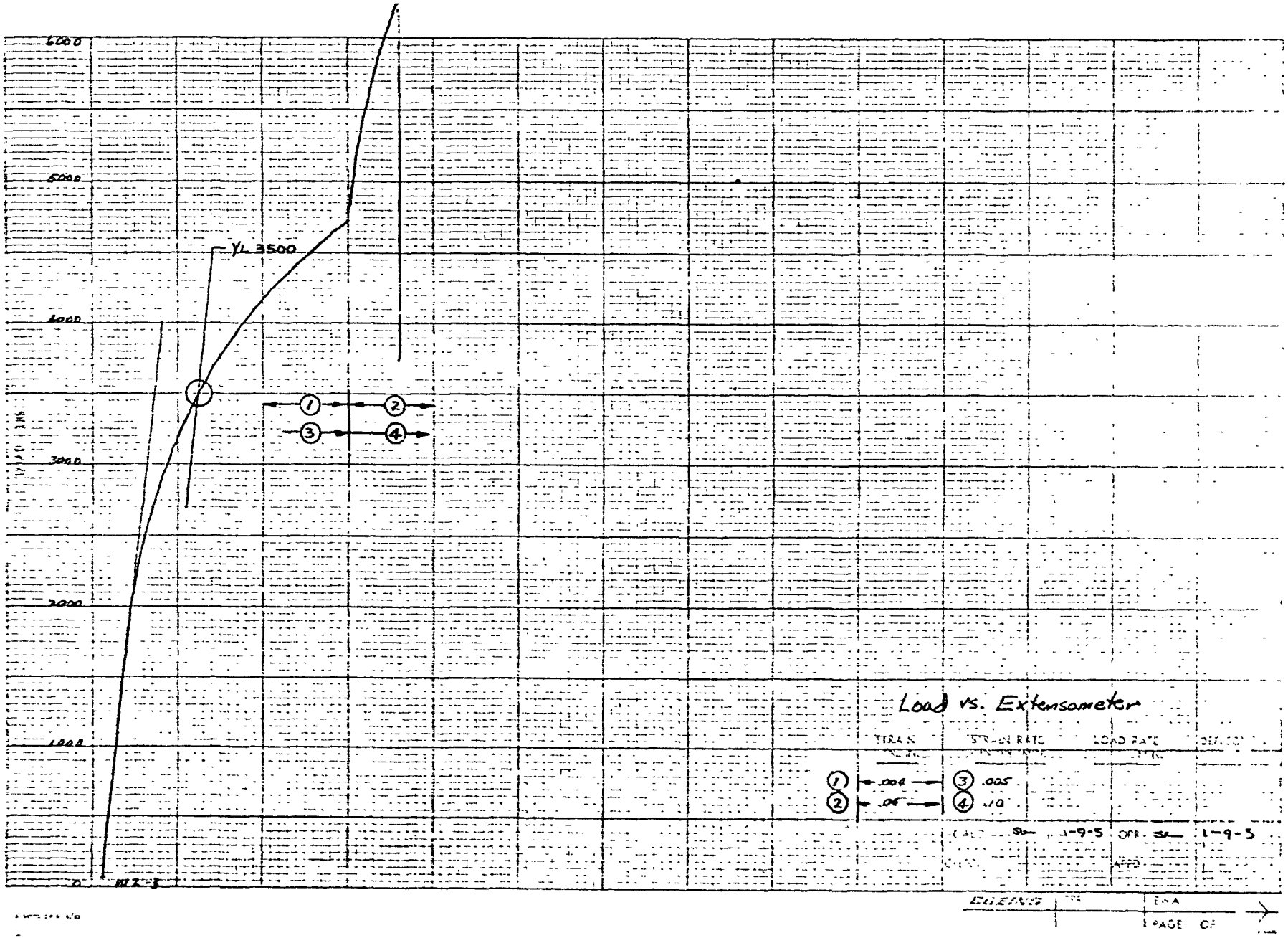


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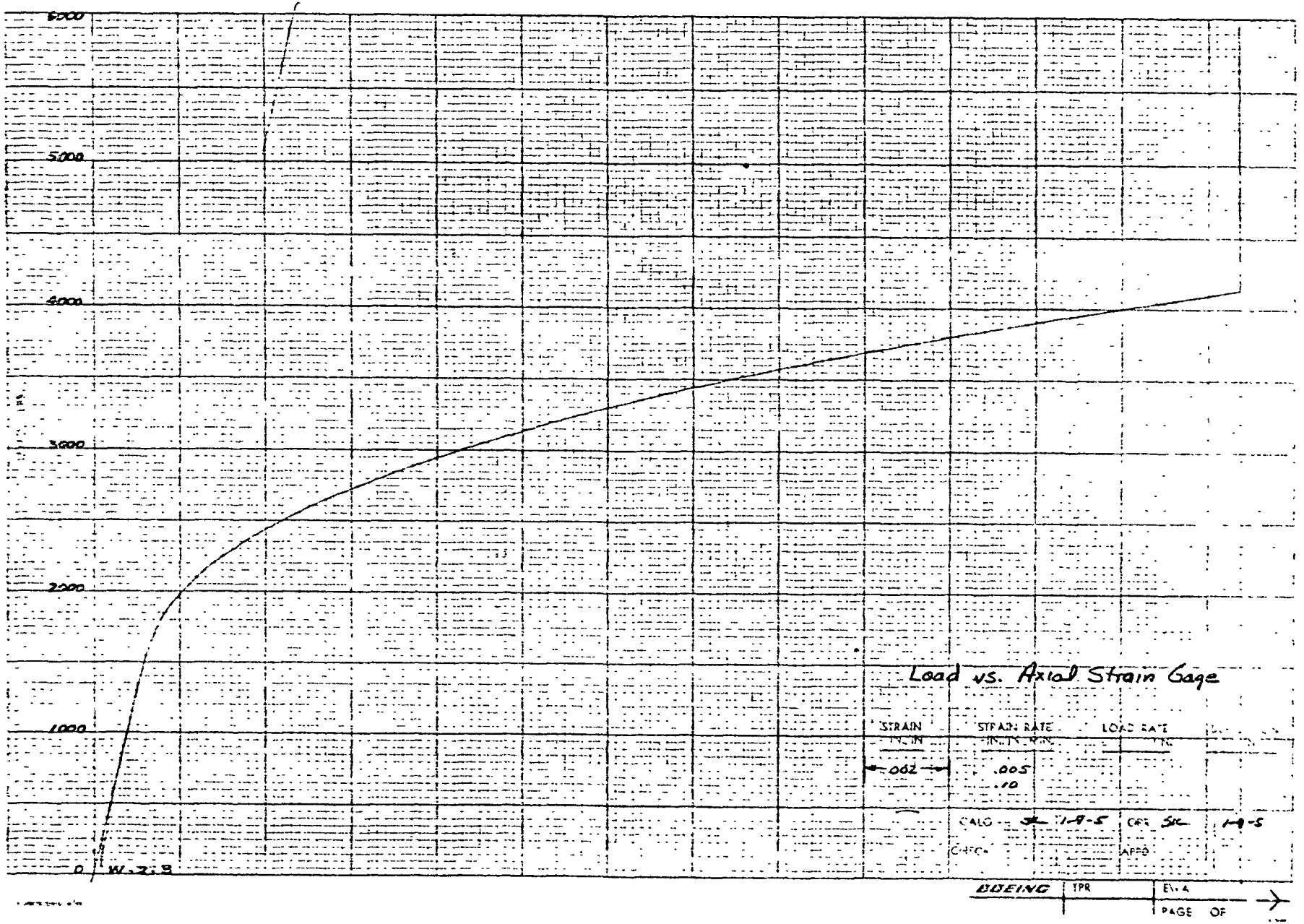


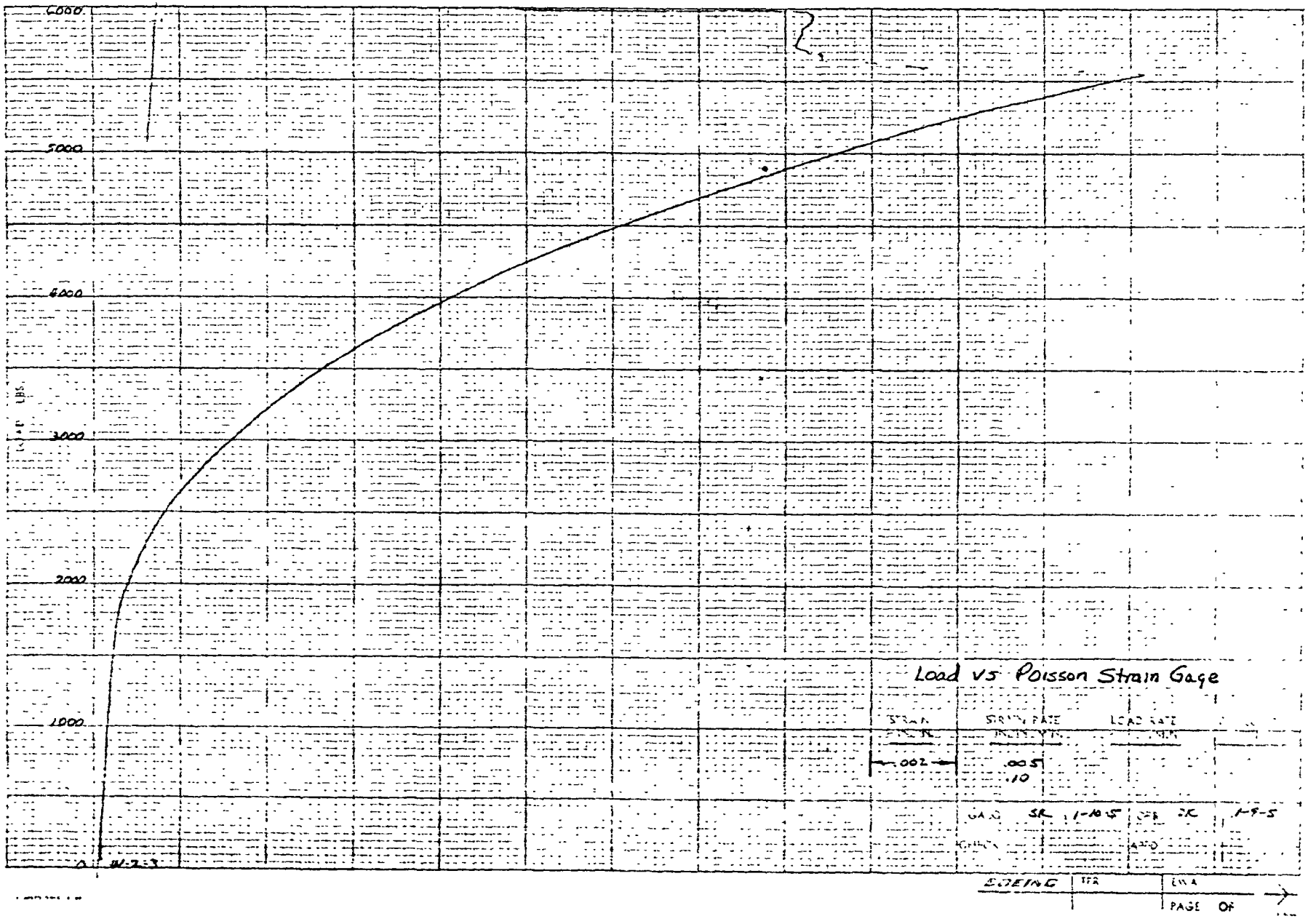


314
for machine only

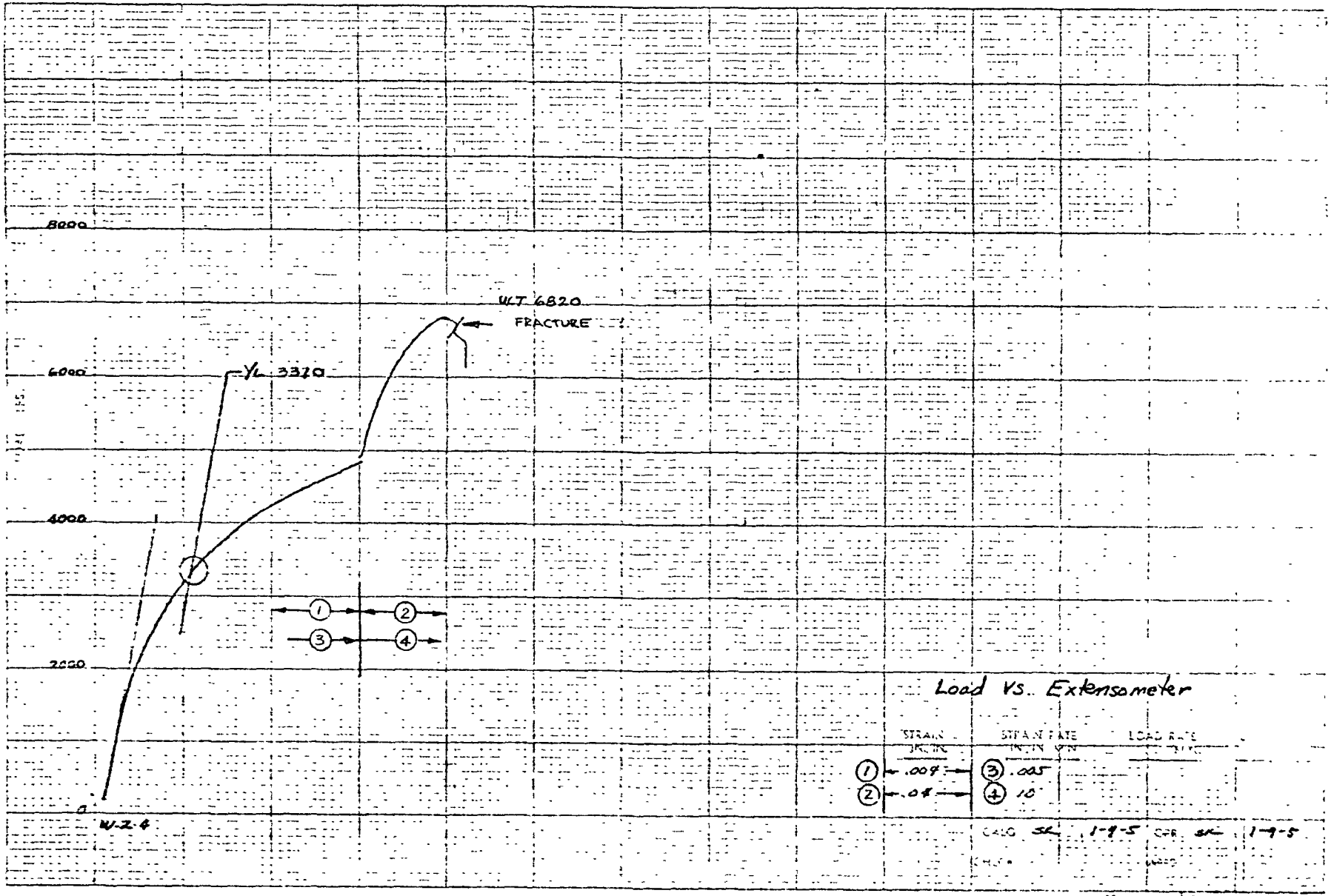


For machine only


6000
5000
4000
3000
2000
1000
0
LBS
Load vs. Axial Strain Gage
STRAIN IN/IN
STRAIN RATE IN/IN/MIN
LOAD RATE LBS/MIN
.002
.005
.10
CALC
CHKD
APPD
BOEING
TPR
PAGE OF


6000
5000
4000
3000
2000
1000
0
LOAD LBS.
Load vs Poisson Strain Gage
STRAIN
.002
STRAIN RATE
.005
.10
LOAD RATE
GAGE SR 1-10-5
CHECK
BOEING
PAGE OF

for machine only



Load Vs. Extensometer

	STRAIN IN/IN/MIN		STRAIN RATE IN/IN/MIN	LOAD RATE KSI/MIN
1	.004	3	.005	
2	.04	4	.10	

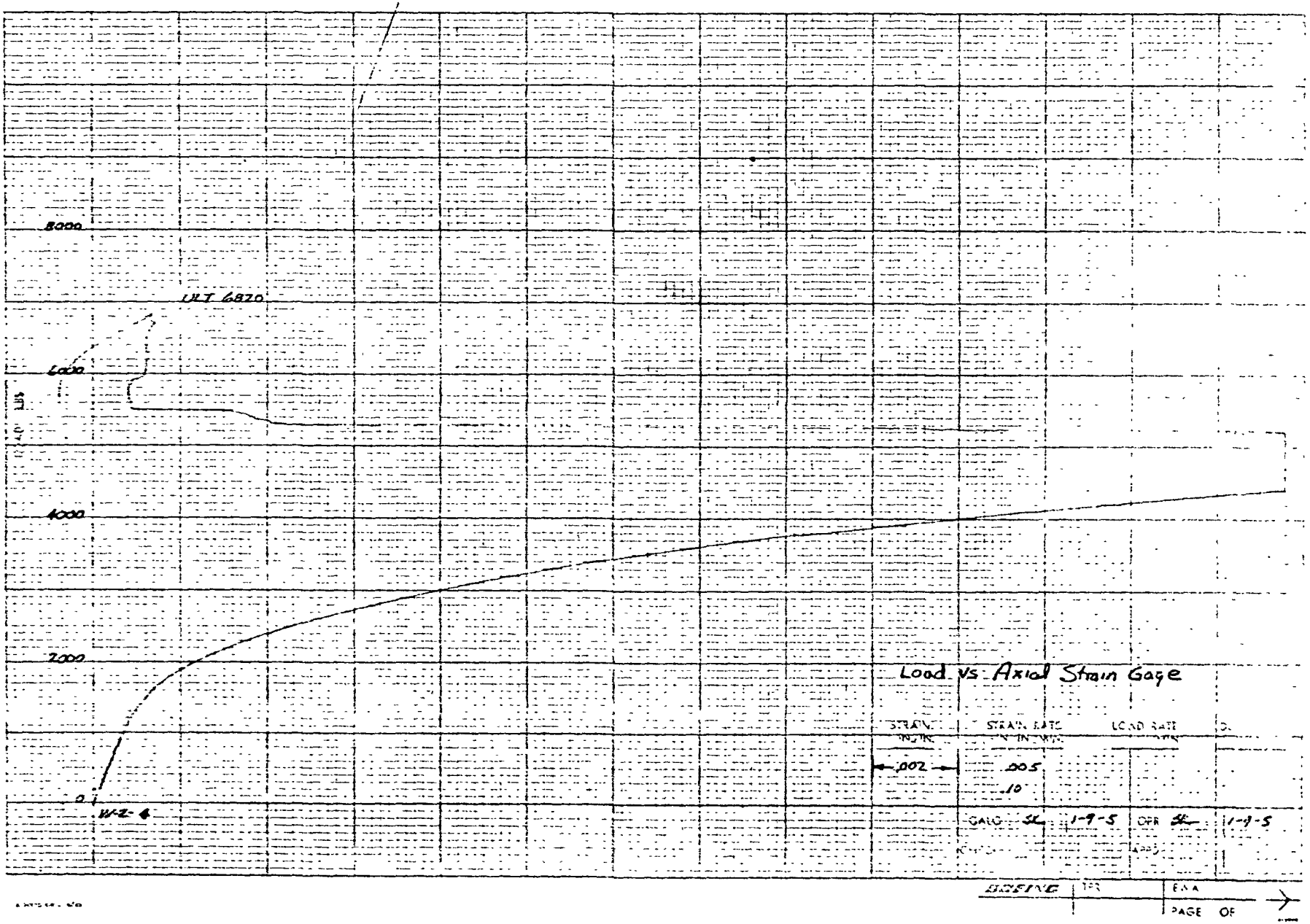
CALC SK 1-9-5 CHK SK 1-9-5

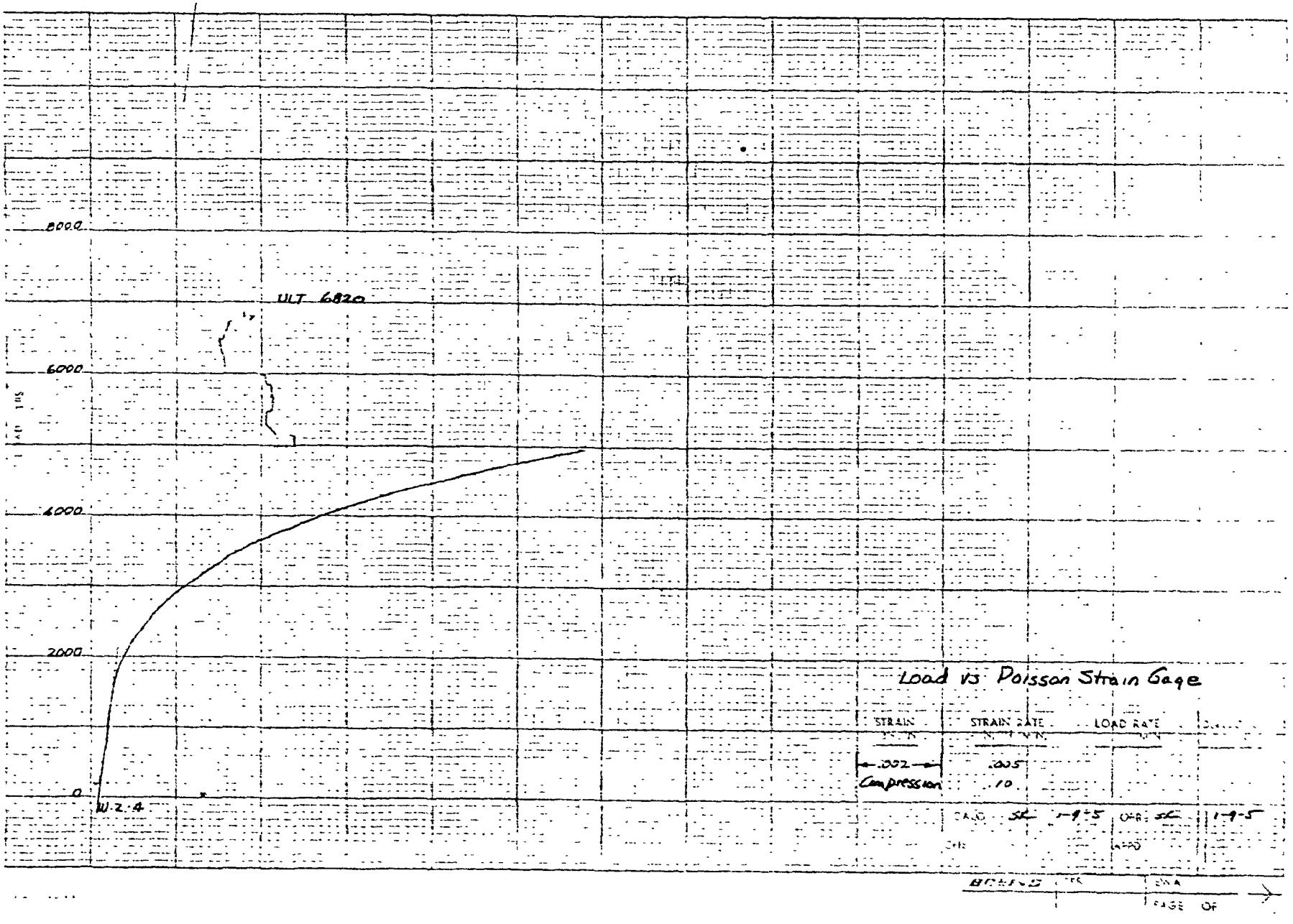
CHK'D DATE

BOEING

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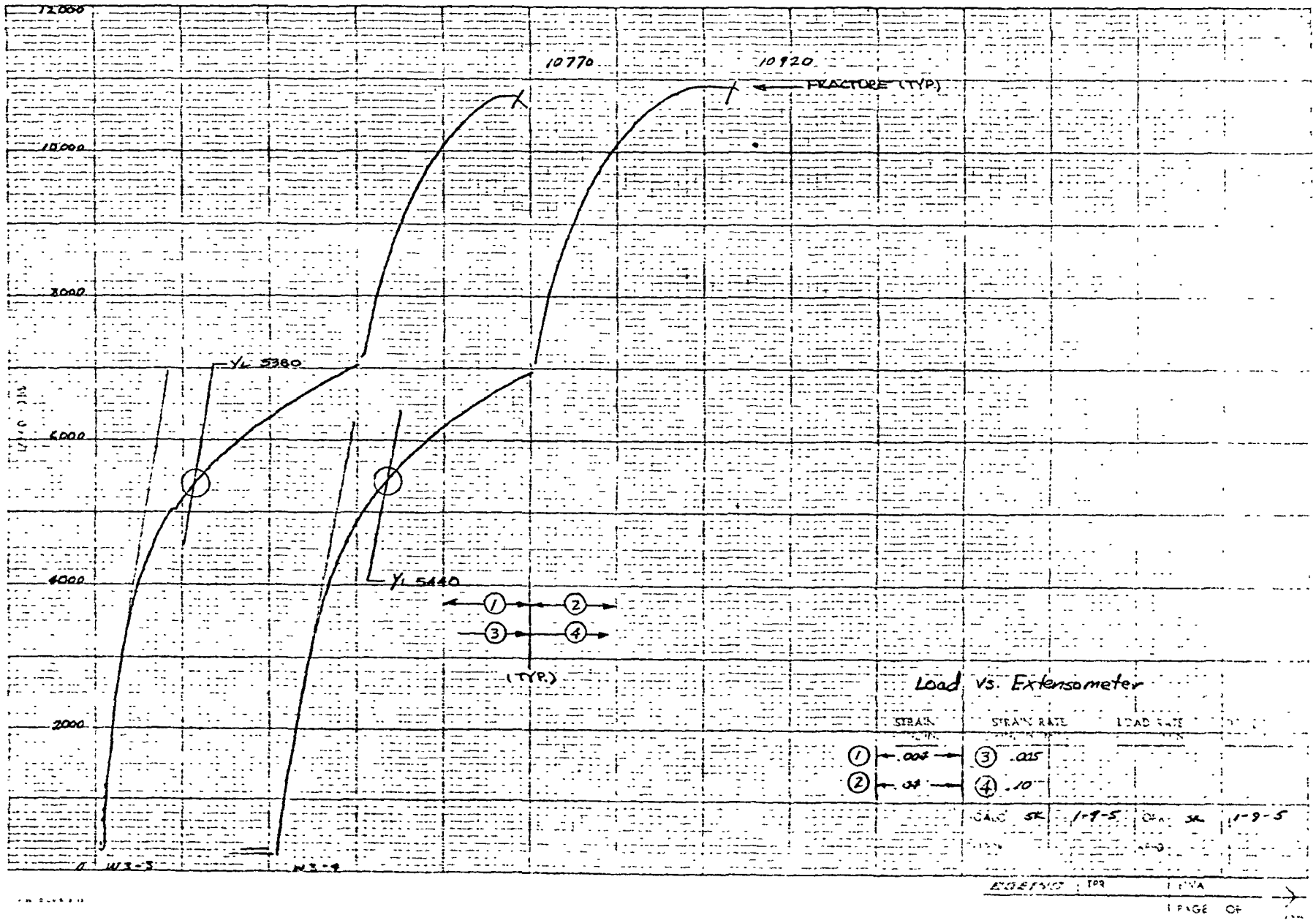
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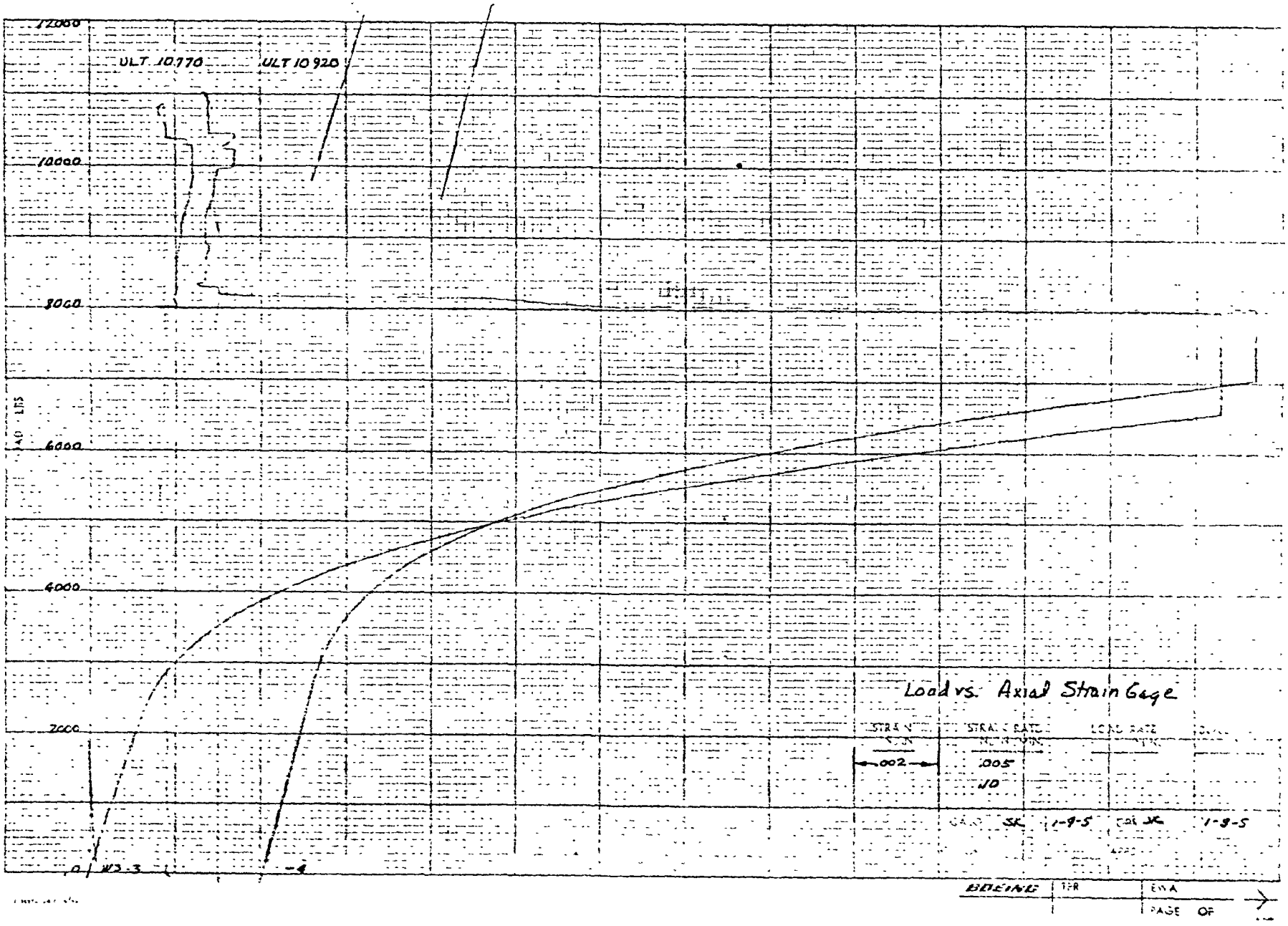


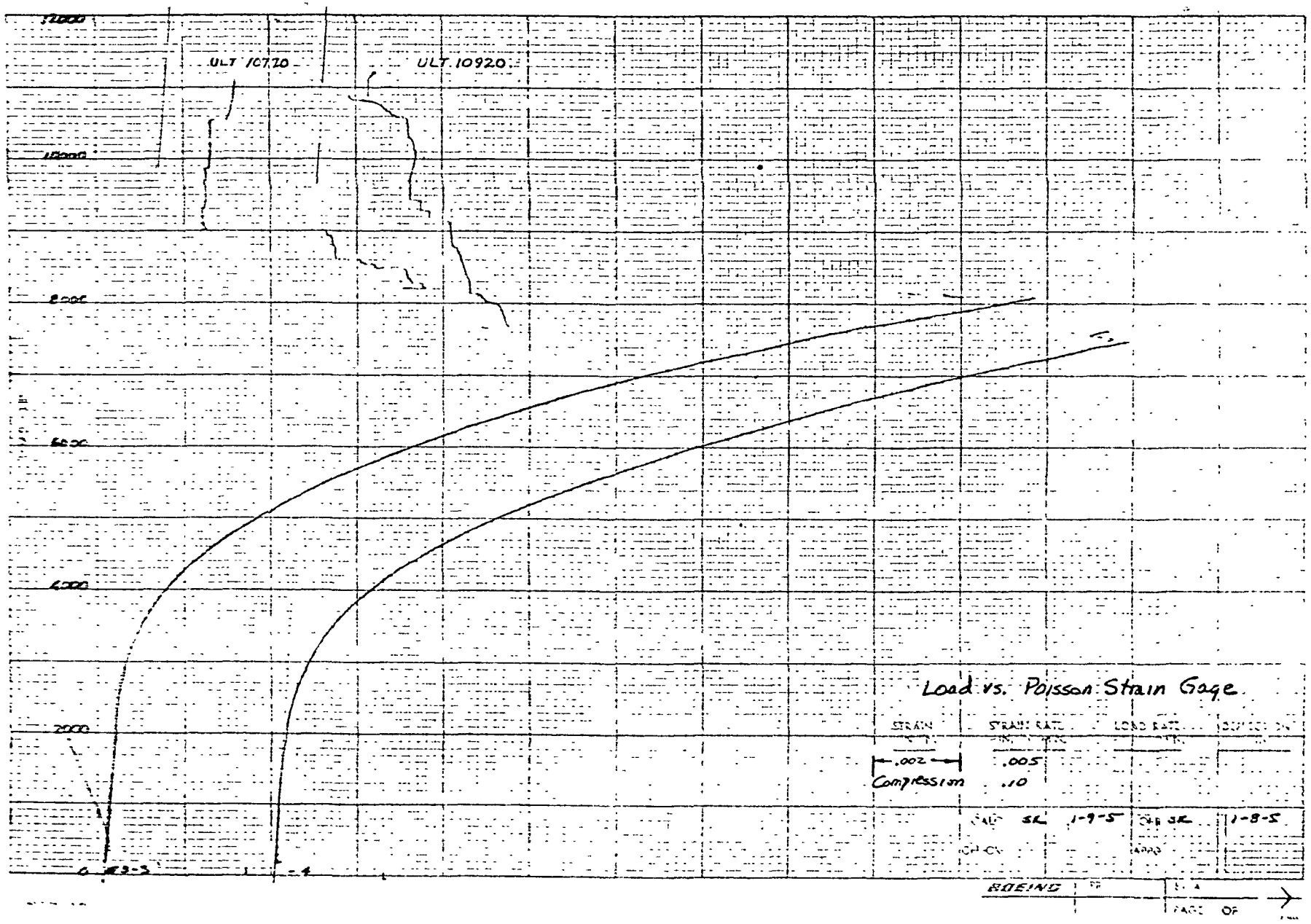
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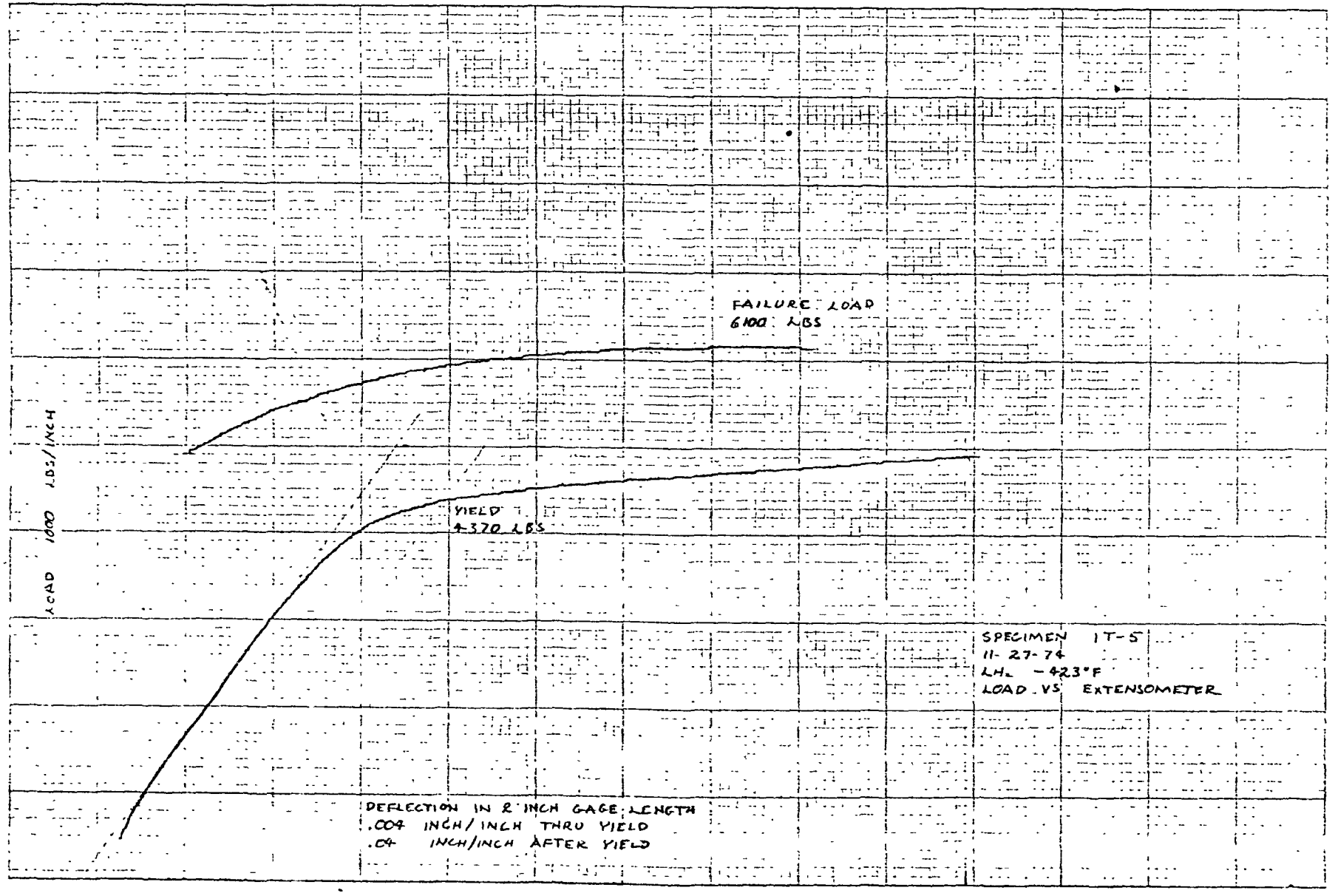
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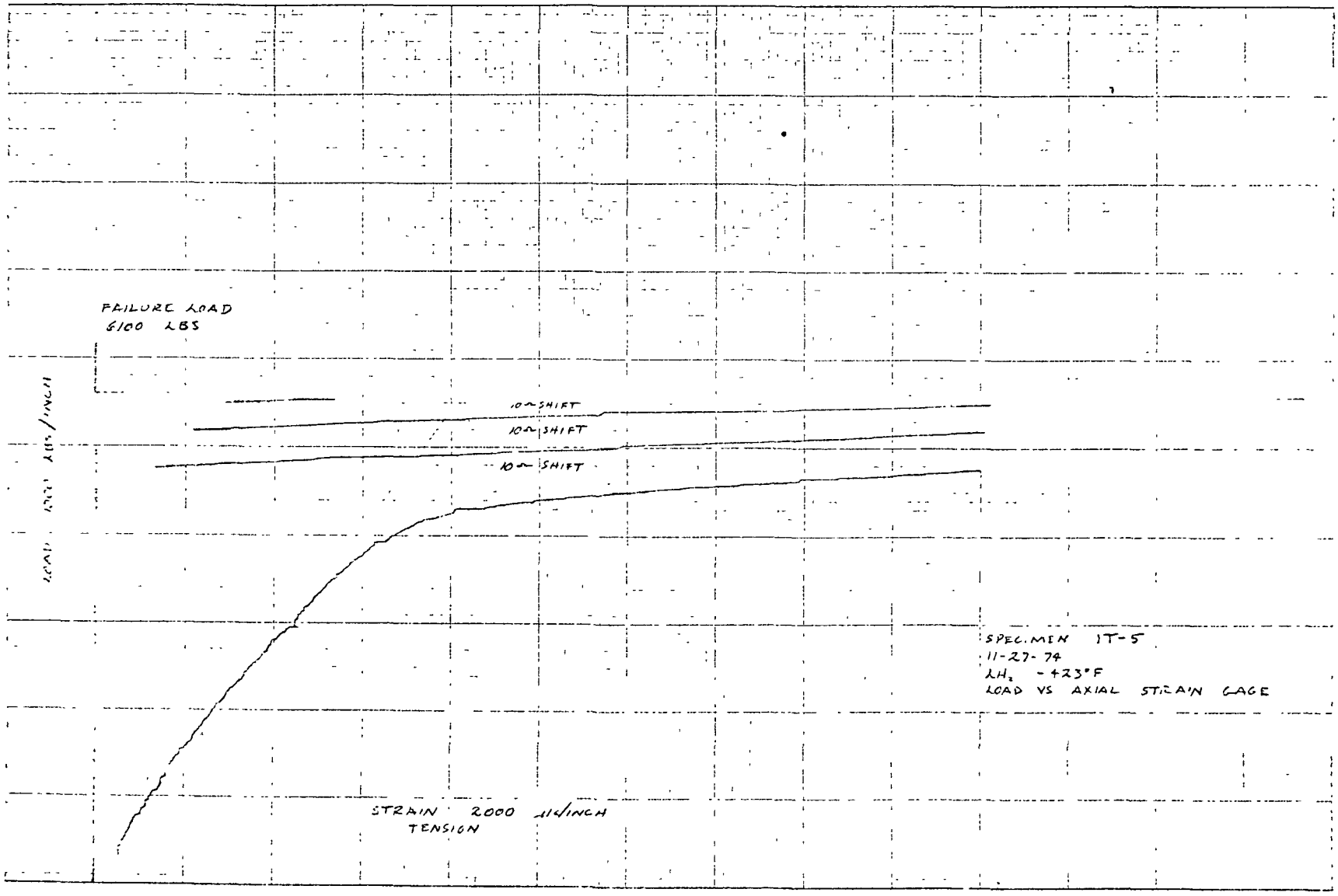


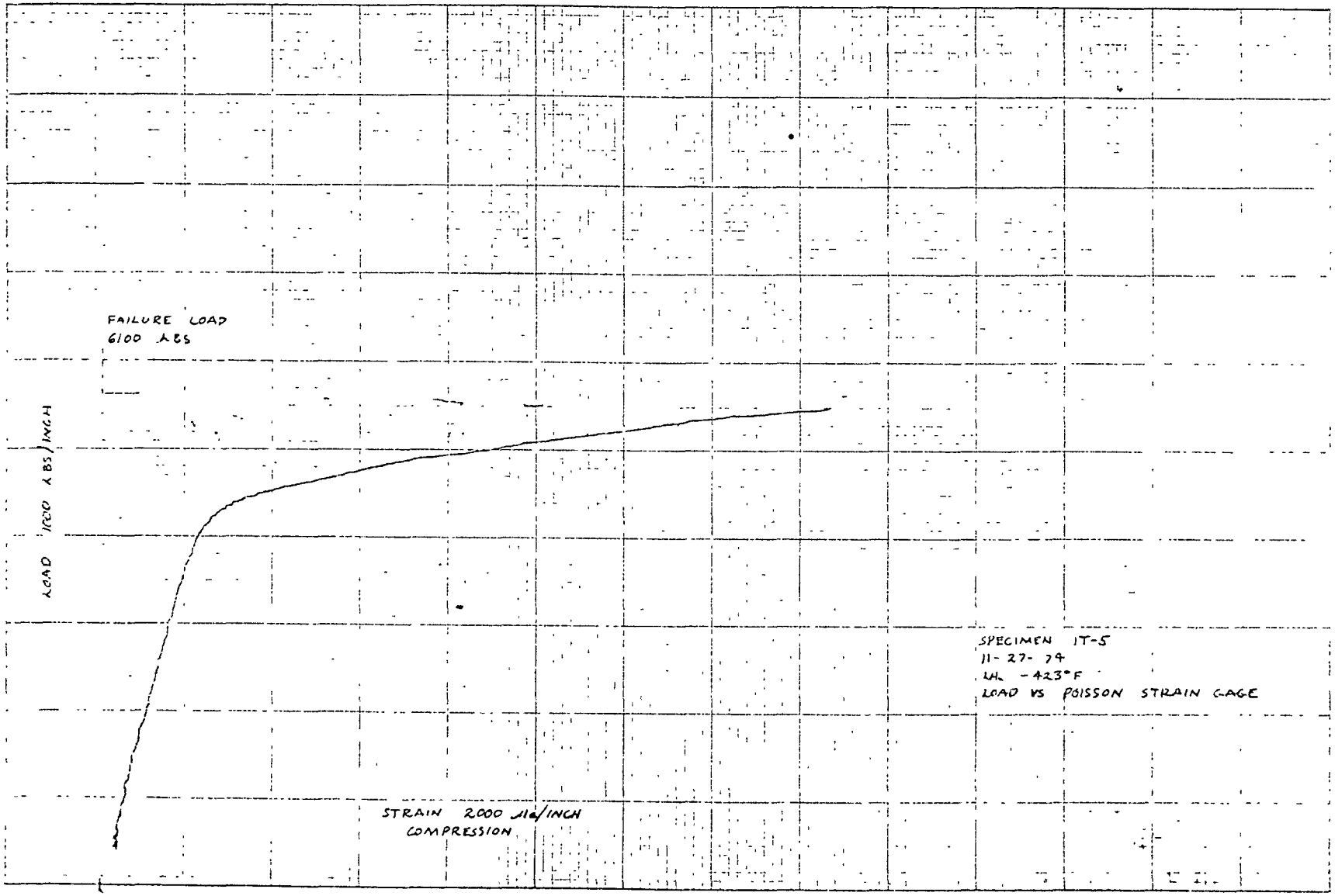
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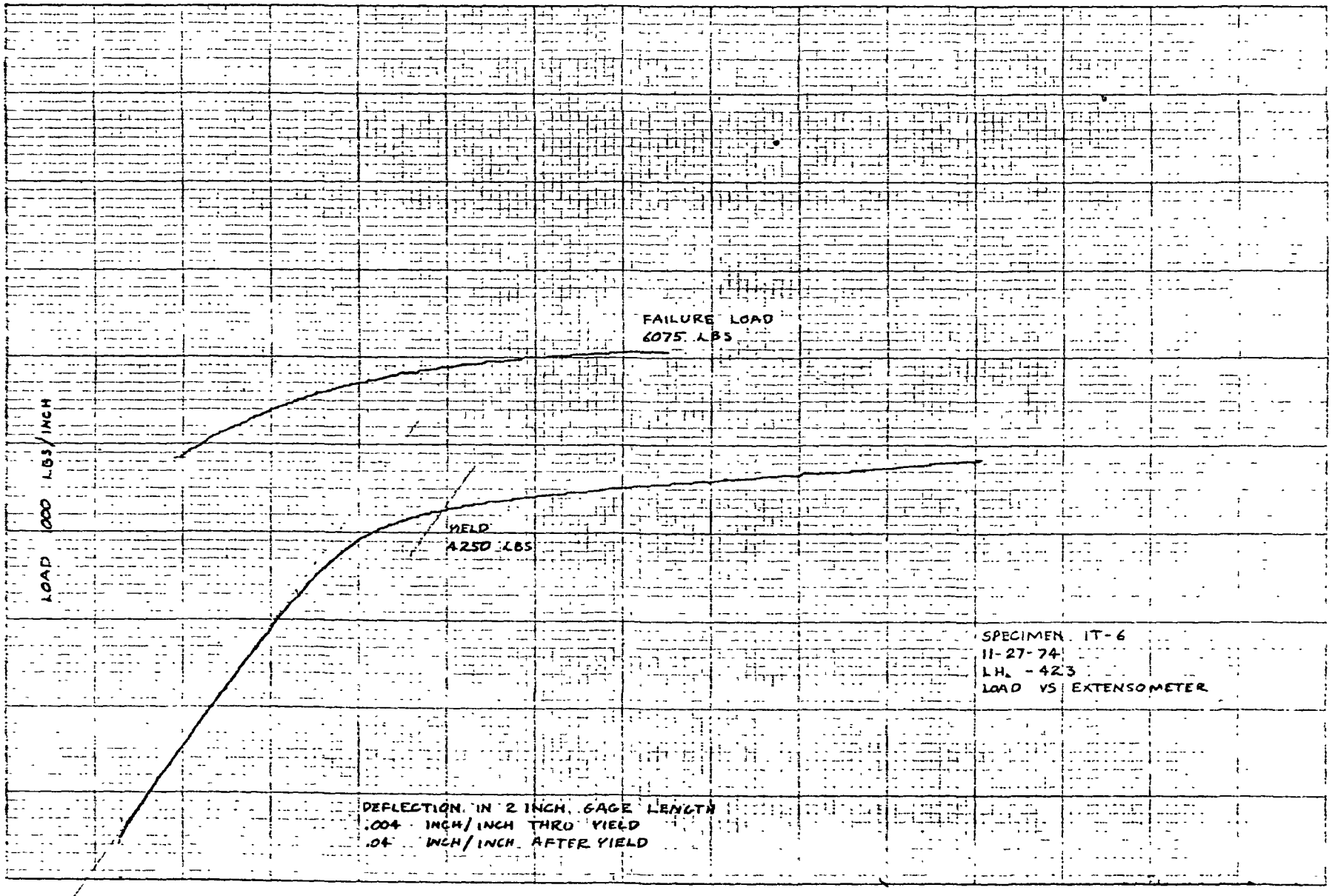

12000
ULT 10770
ULT 10920
10000
8000
6000
4000
2000
0
W2-3
-4
Load vs. Axial Strain Gage
STRAIN
.002
STRAIN RATE
.005
.10
LOAD RATE
1-9-5
1-9-5
BOEING
TER
EWA
PAGE OF


ULT 10770
ULT 10920
Load vs. Poisson Strain Gage
STRAIN
.002
Compression
.005
.10
1-9-5
1-8-5
BOEING

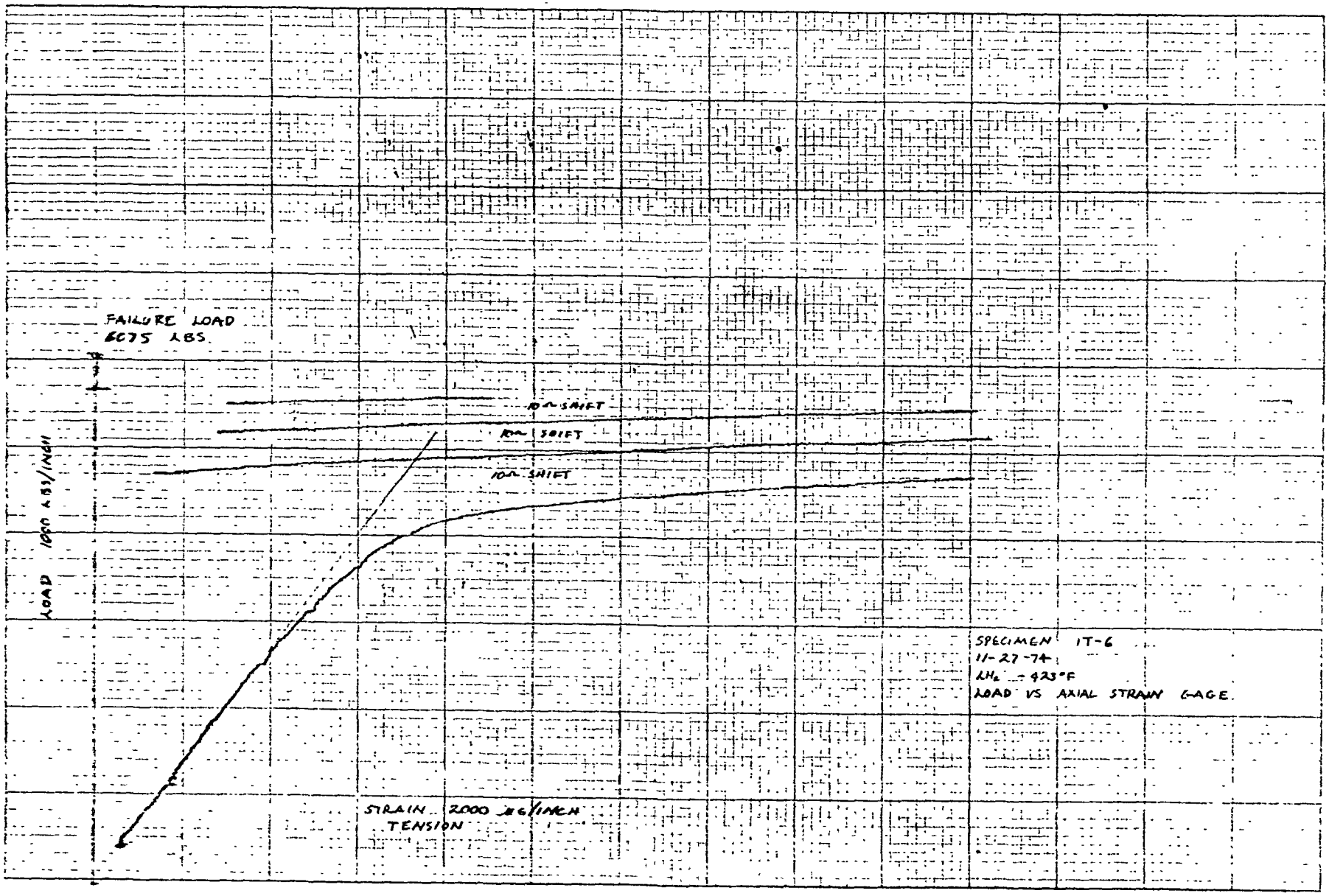

FAILURE LOAD
6100 LBS
YIELD
4370 LBS
LOAD .0001 INCH/LBS
SPECIMEN 1T-5
11-27-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

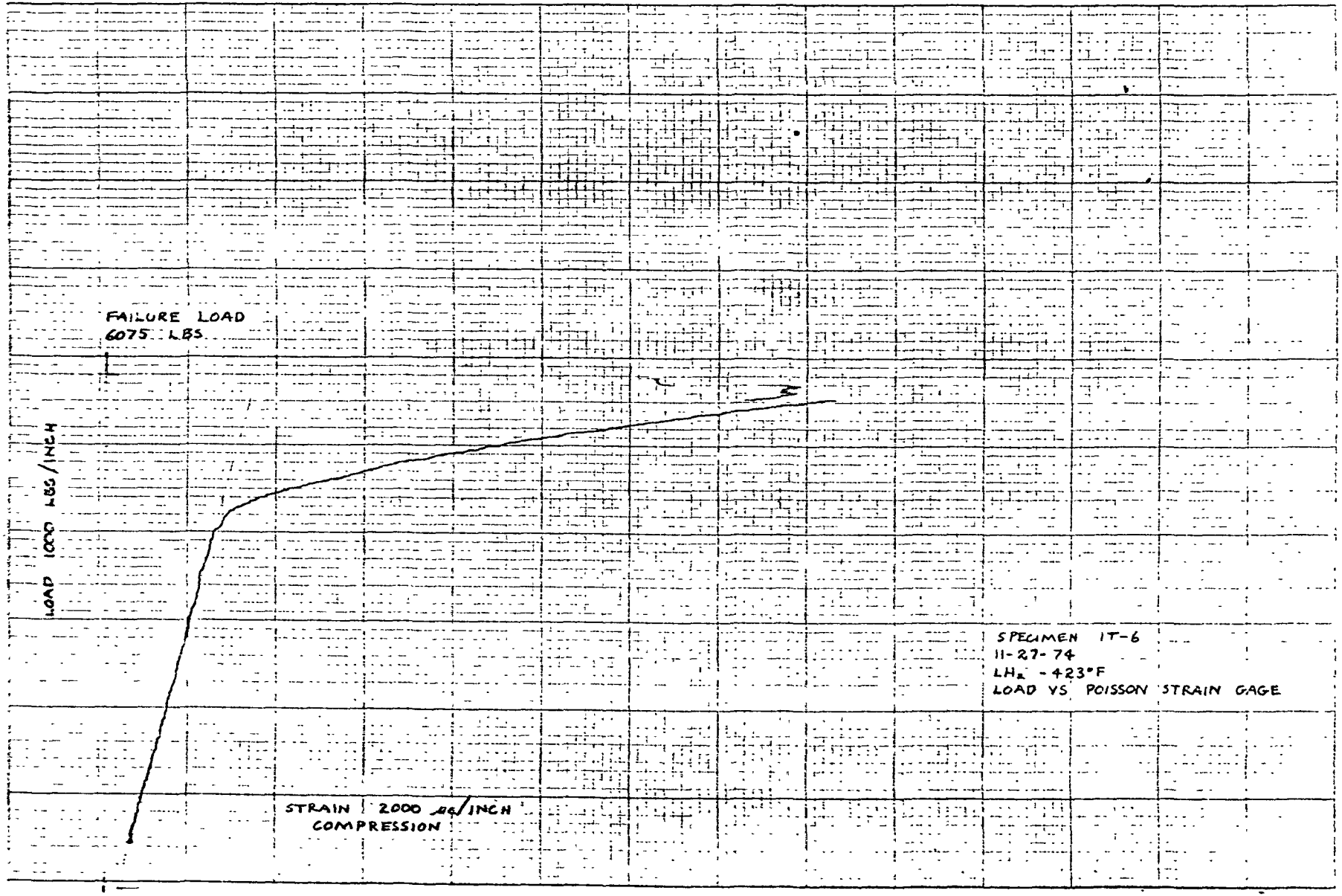

FAILURE LOAD
6100 LBS
LOAD 1000 LBS/INCH
10 SHIFT
10 SHIFT
10 SHIFT
SPEC. MEN 1T-5
11-27-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE
STRAIN 2000 µ/INCH
TENSION

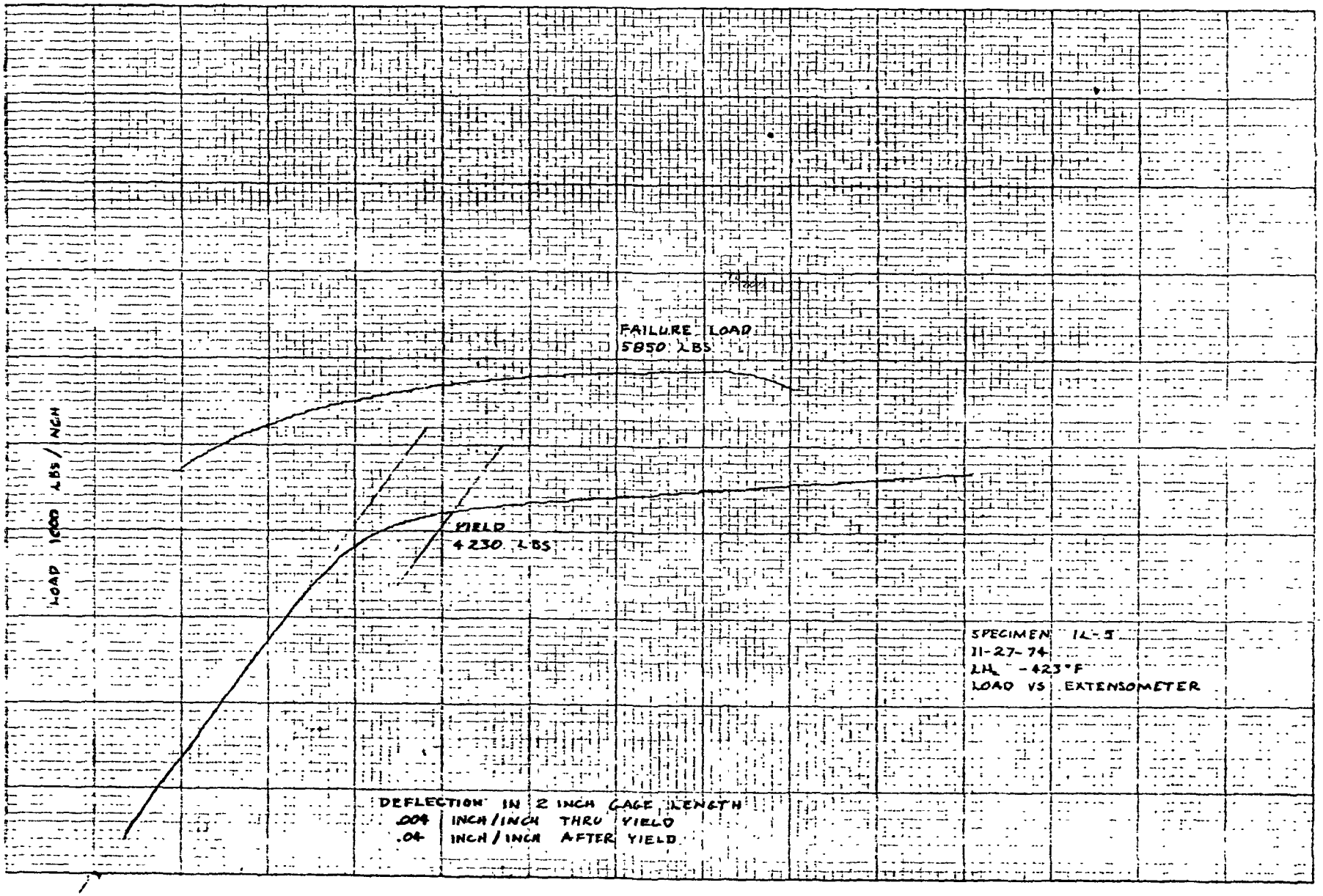

FAILURE LOAD
6100 LBS
LOAD 1000 LBS/INCH
STRAIN 2000 μ in/INCH
COMPRESSION
SPECIMEN IT-5
11-27-79
LH -423°F
LOAD VS POISSON STRAIN GAGE

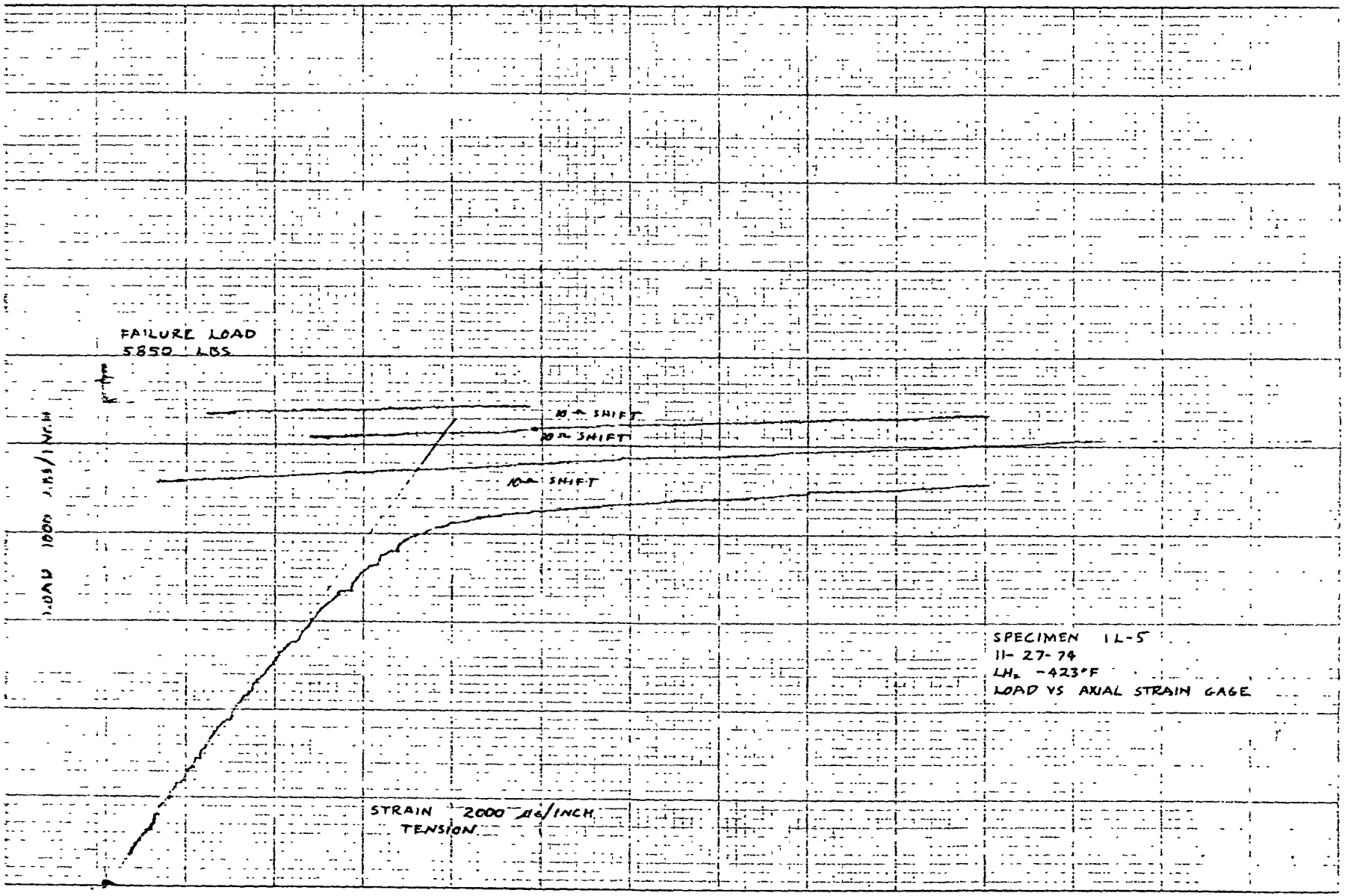

FAILURE LOAD
6075 LBS
YIELD
4250 LBS
LOAD 000 LBS/INCH
SPECIMEN IT-6
11-27-74
LH. -423
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

IT-6
SG1

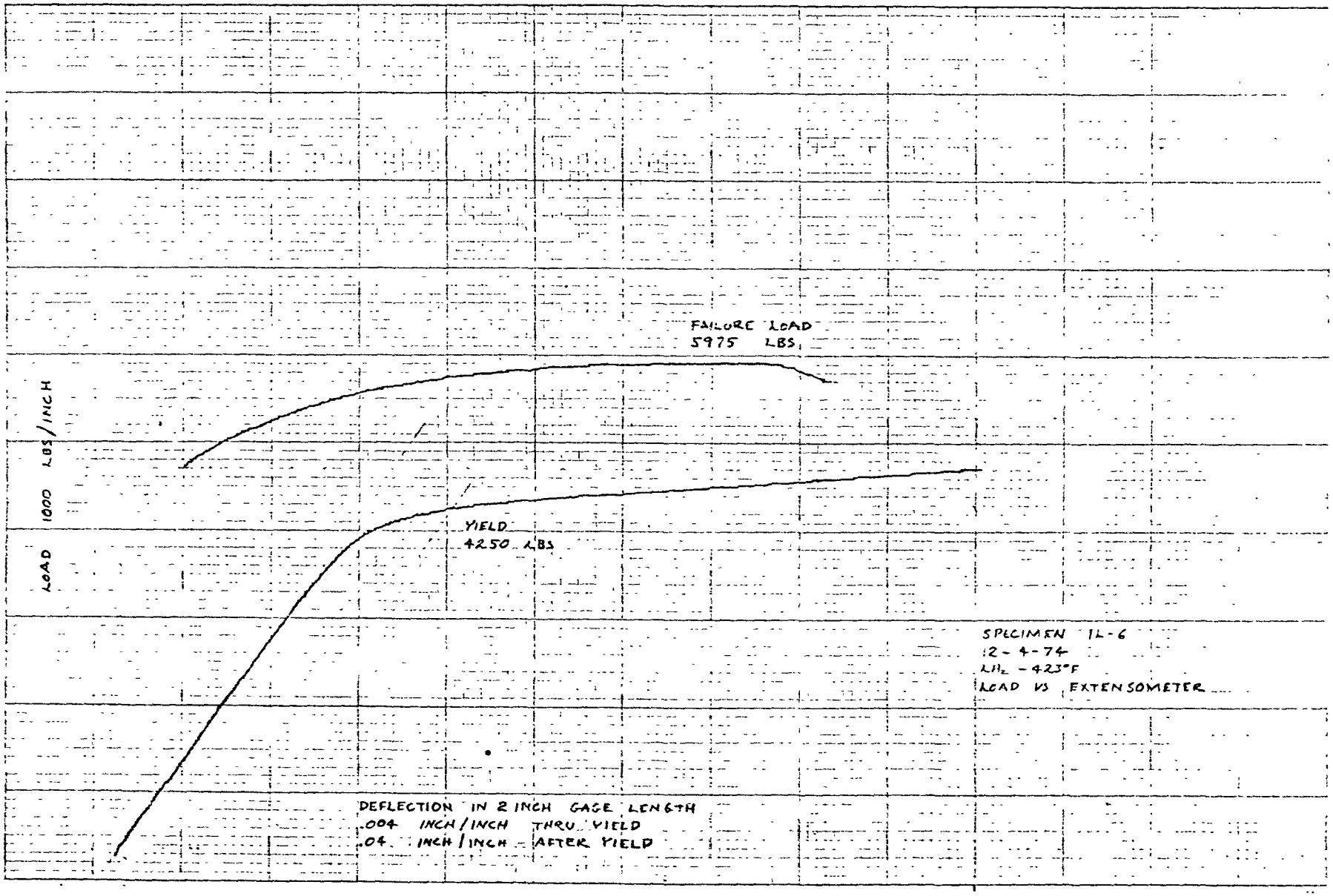

FAILURE LOAD
6075 LBS.
10Ω SHIFT
10Ω SHIFT
10Ω SHIFT
LOAD 1000 LBS/INCH
STRAIN 2000 μ IN/INCH
TENSION
SPECIMEN IT-6
11-27-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE


FAILURE LOAD
6075 LBS.
LOAD 1000 LBS/INCH
STRAIN 2000 μ/INCH
COMPRESSION
SPECIMEN IT-6
11-27-74
LH2 -423°F
LOAD VS POISSON STRAIN GAGE


FAILURE LOAD
5850 LBS
YIELD
4230 LBS
LOAD 1000 LBS / INCH
SPECIMEN IL-5
11-27-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

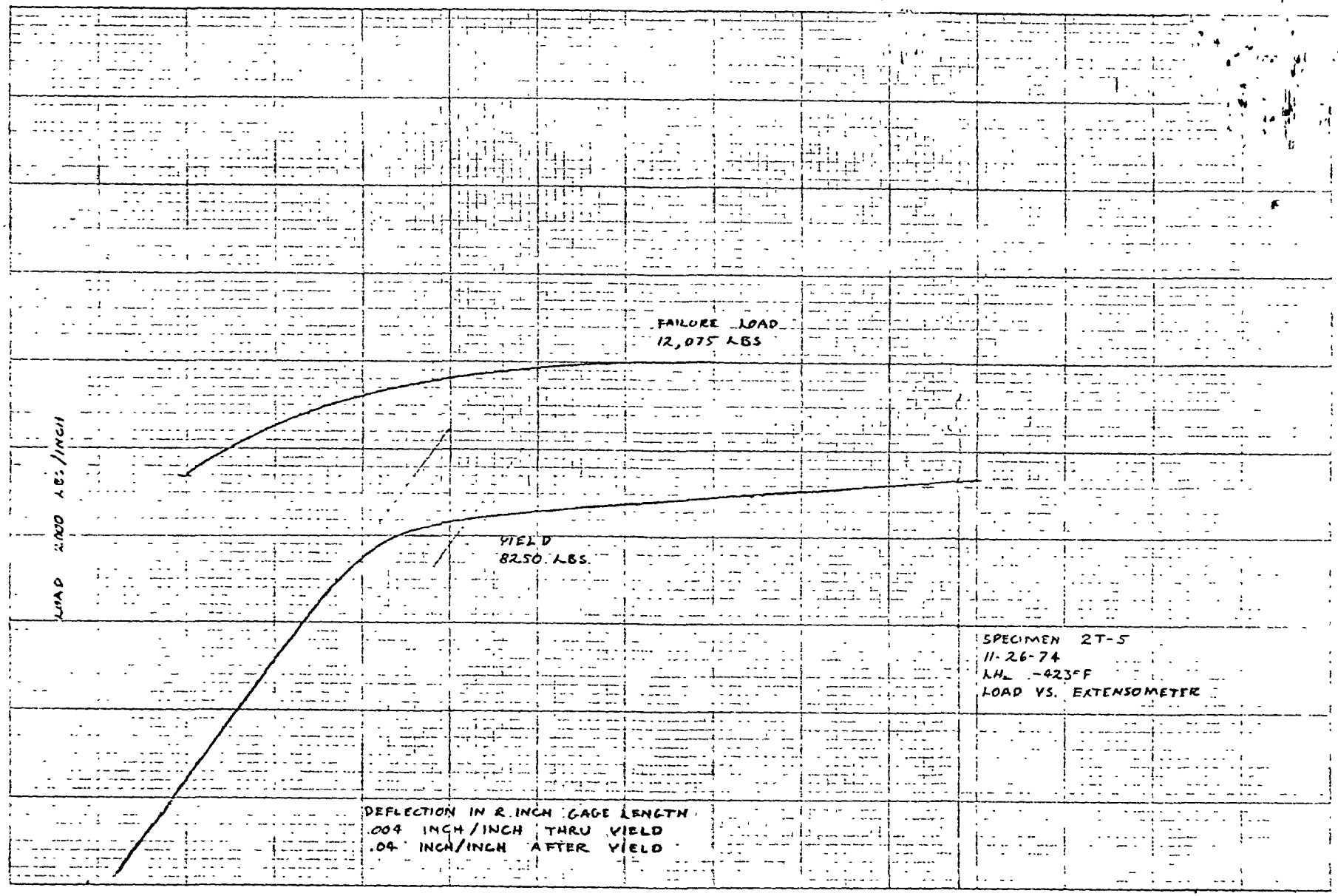

FAILURE LOAD
5850 LBS
LOAD 1000 LBS/1 INCH
10 SHIFT
20 SHIFT
10 SHIFT
SPECIMEN 1L-5
11-27-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE
STRAIN 2000 μ/INCH
TENSION

SPECIMEN 1L-5
11-27-74
LHL - 423°F
LOAD VS POISSON STRAIN GAGE
FAILURE LOAD
5850 LBS
LOAD 1000 LBS/INCH
STRAIN 2000 μ"/INCH
COMPRESSION


FAILURE LOAD
5975 LBS
YIELD
4250 LBS
LOAD 1000 LBS/INCH
SPECIMEN IL-6
2-4-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

SPECIMEN 1L-6
12-4-74
LH₂ -423°F
LOAD VS AXIAL STRAIN GAGE
FAILURE LOAD
5975 LBS
BOLT SHIFT
10 K SHIFT
LOAD 1000 LBS/INCH
STRAIN 2000 με/INCH
TENSION

SPECIMEN 1L-6
12-9-74
RM -423°F
LOAD VS POISSON STRAIN GAGE
FAILURE LOAD
5975 LBS
LOAD 1000 LBS/INCH
STRAIN 2000 μ6/INCH
COMPRESSION

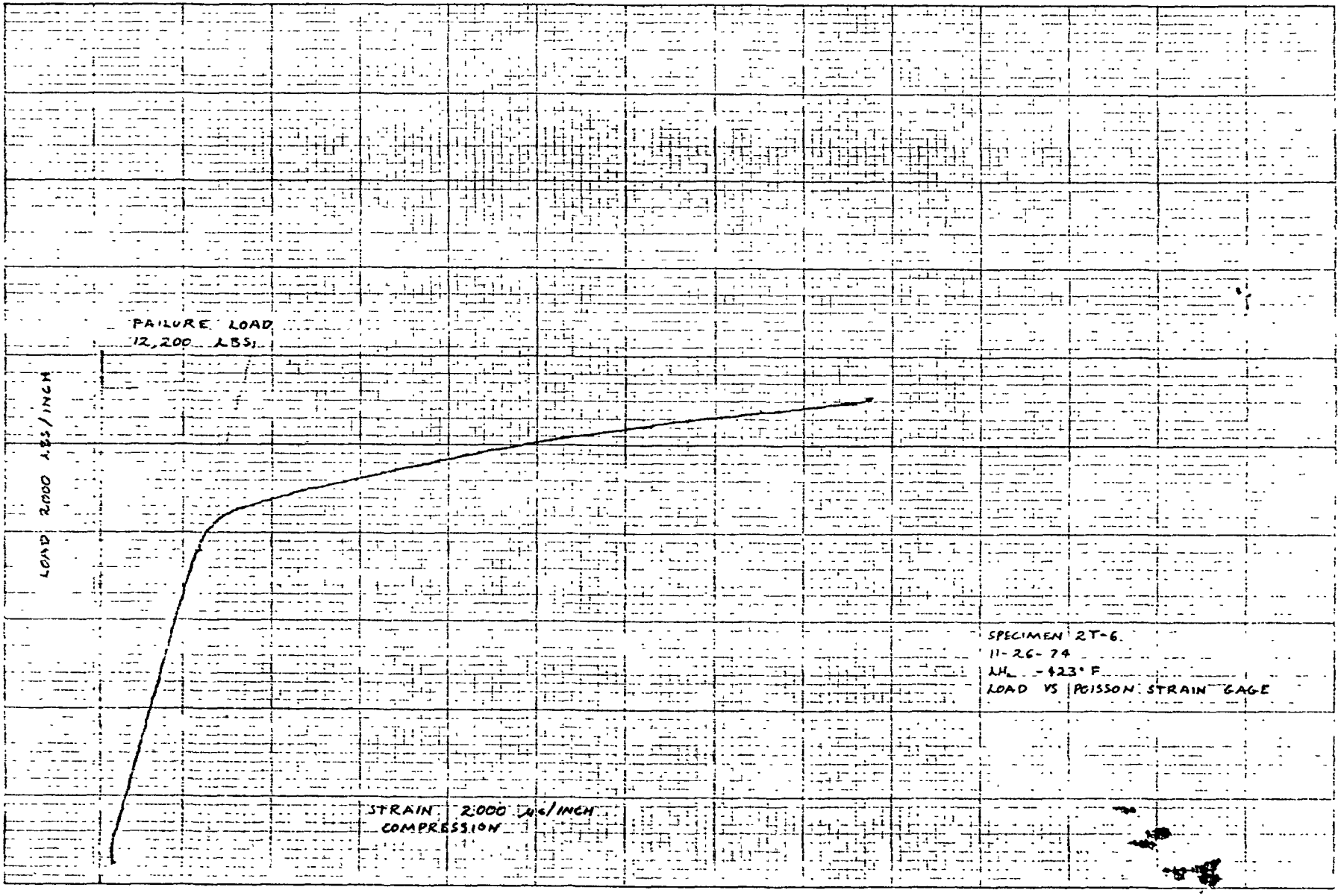

FAILURE LOAD
12,075 LBS
YIELD
8250 LBS.
LOAD 2000 LBS/INCH
DEFLECTION IN 8 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
SPECIMEN 2T-5
11-26-74
LH2 -423°F
LOAD VS. EXTENSOMETER

FAILURE LOAD
18,075 LBS
SPECIMEN 2T-5
11-26-74
RM -423°F
LOAD VS. AXIAL STRAIN GAGE
10 K SHIFT
10 K SHIFT
LOAD 2,000 LBS/INCH
STRAIN 2,000 MU/INCH
TENSION

SPECIMEN 2T-5
11-26-74
LHL -423°F
LOAD VS POISSON STRAIN GAGE
FAILURE LOAD
12,075 LBS
LOAD 2000 LBS/INCH
STRAIN 2000 μ IN/IN
COMPRESSION

LOAD ZERO ABS/INCH
FAILURE LOAD
12,200 LBS
YIELD
8500 LBS
SPECIMEN 2T-6
11-26-74
LH - 423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.04 INCH/INCH THRU YIELD
.01 INCH/INCH AFTER YIELD

SPECIMEN 2T-6
11-26-74
LHe - 423°F
LOAD VS AXIAL STRAIN GAGE
STRAIN 2000 μ/INCH
TENSION
LOAD 2000 LBS/INCH
FAILURE LOAD
12,200 LBS
10 SHIFT
10 SHIFT


FAILURE LOAD
12,200 LBS.
LOAD 2000 LBS/INCH
STRAIN 2000 μ/INCH
COMPRESSION
SPECIMEN 2T-6
11-26-74
ΔH -423° F
LOAD VS POISSON STRAIN GAGE

SPECIMEN 2L-5
11-25-74
LWL - 42.0°F
LOAD VS EXTENSOMETER
FAILURE LOAD
11,850 LBS
YIELD
8,500 LBS
LOAD 8000 LBS/INCH
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

FAILURE LOAD
11,850 LBS
LOAD 2000 LBS/INCH
10 MINS
10 MINS
SPECIMEN 22-5
11-25-74
-423°F
LOAD VS AXIAL STRAIN GAGE
STRAIN 2227 IN/INCH
TENSION

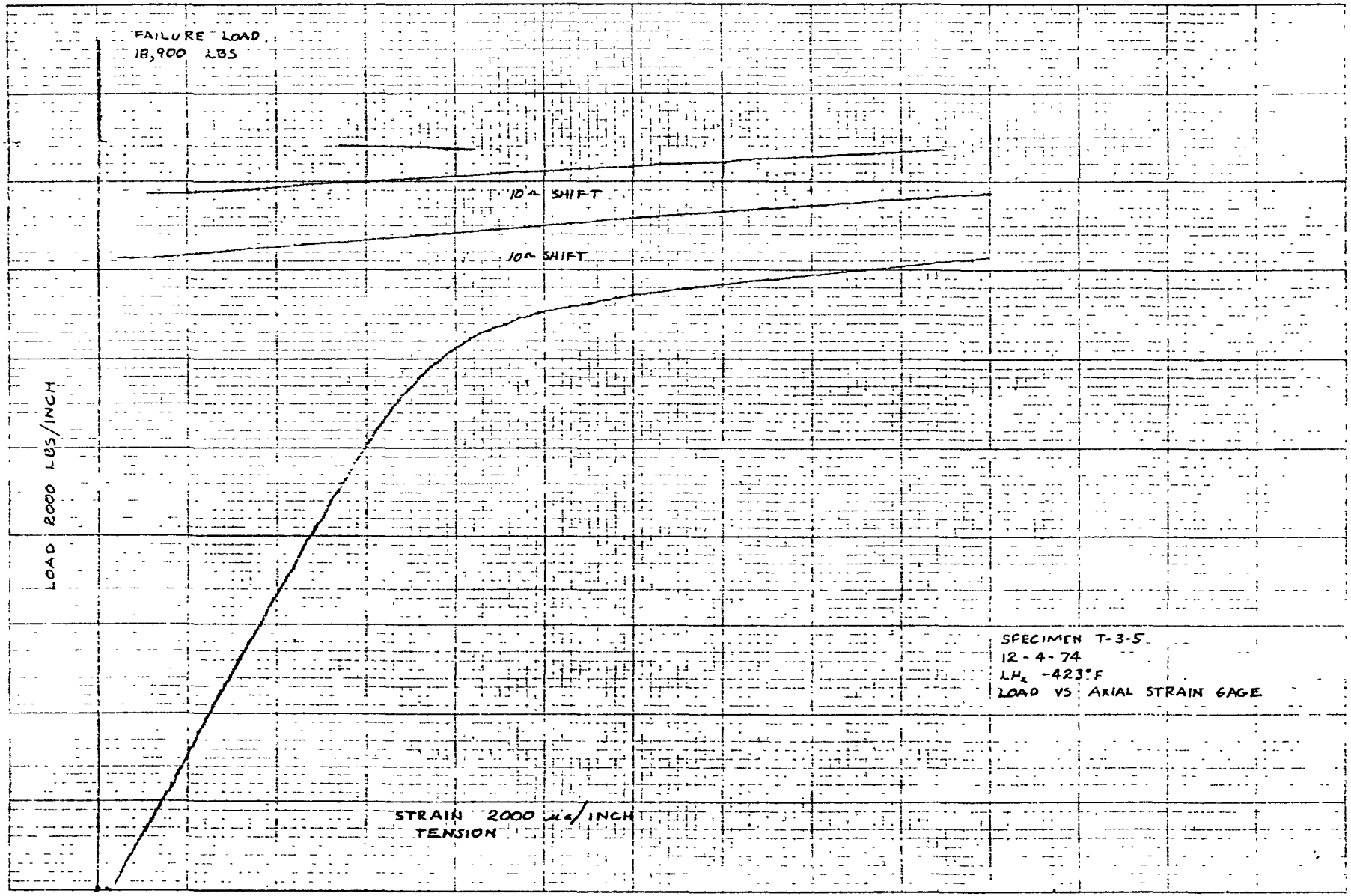
SPECIMEN 2L-5
11-25-74
LN2 -423°F
LOAD VS POISSON STRAIN GAGE
STRAIN 2000 μ in/in
COMPRESSION
LOAD 2000 LBS/INCH
2-SEC LOAD
1/2 SEC LBS

SPECIMEN 21-6
11-26-74
LH2 -423°F
LOAD VS EXTENSOMETER
FAILURE LOAD
11,575 LBS
YIELD
8300 LBS
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
LOAD 2000 LBS/INCH

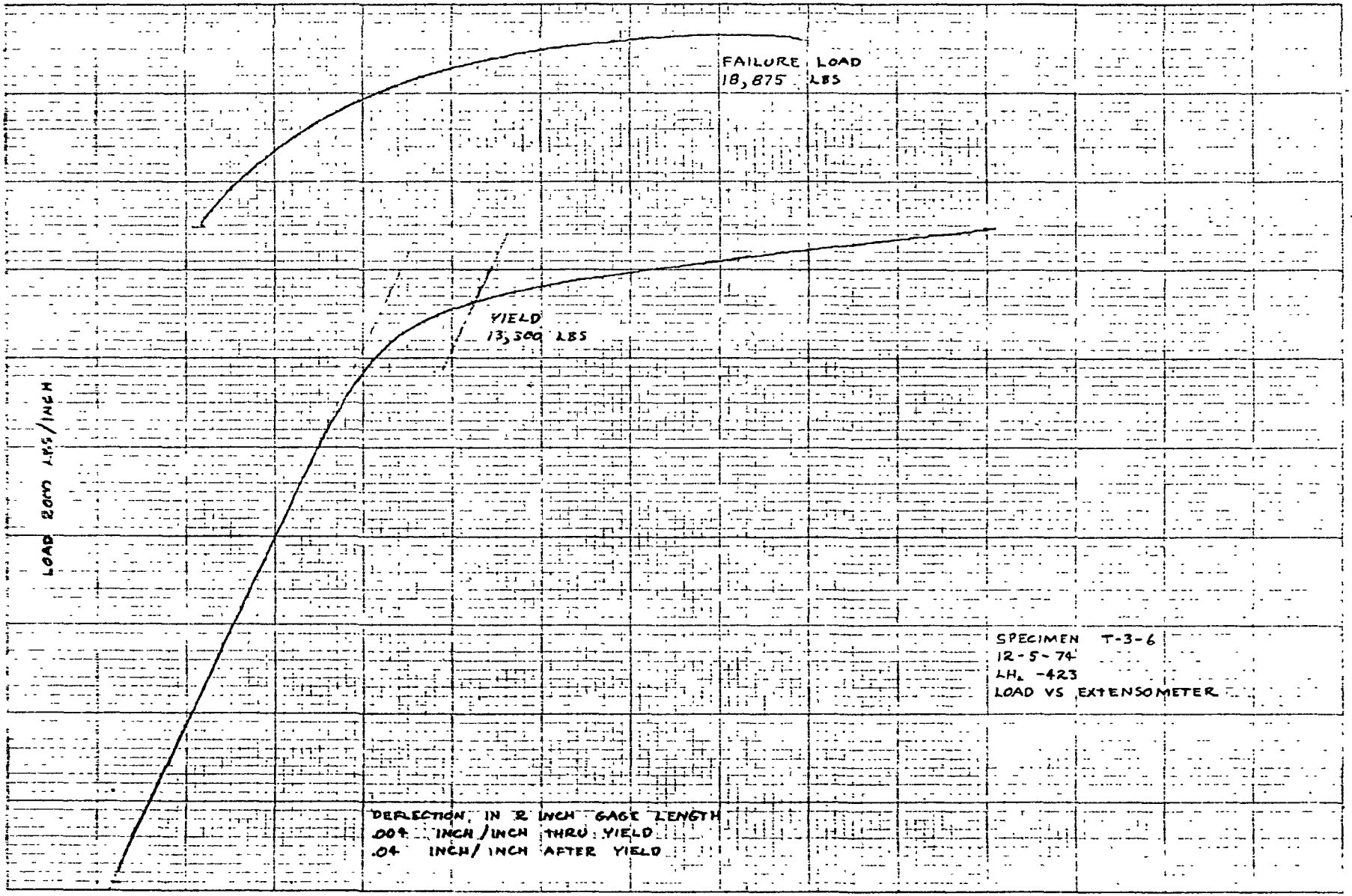
SPECIMEN 2L-6
11-26-74
RM -423°F
LOAD VS AXIAL STRAIN GAGE
FAILURE LOAD
11,575 LBS
NO SHIFT
NO SHIFT
LOAD 2000 LBS/INCH
STRAIN 2000 μ"/INCH
TENSION

SPECIMEN 24-6
11-26-74
LAL -423°F
LOAD VS. POISSON STRAIN GAGE
FAILURE LOAD
11,575 LBS
STRAIN 2000 μ/INCH
COMPRESSION

FAILURE LOAD
18,900 LBS
YIELD
13,000 LBS
LOAD 2000 LBS/INCH
SPECIMEN T-3-5
12-4-74
LN. -423°F.
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD


FAILURE LOAD
18,900 LBS
10^ SHIFT
10^ SHIFT
LOAD 2000 LBS/INCH
STRAIN 2000 μ in/INCH
TENSION
SPECIMEN T-3-5
12-4-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE

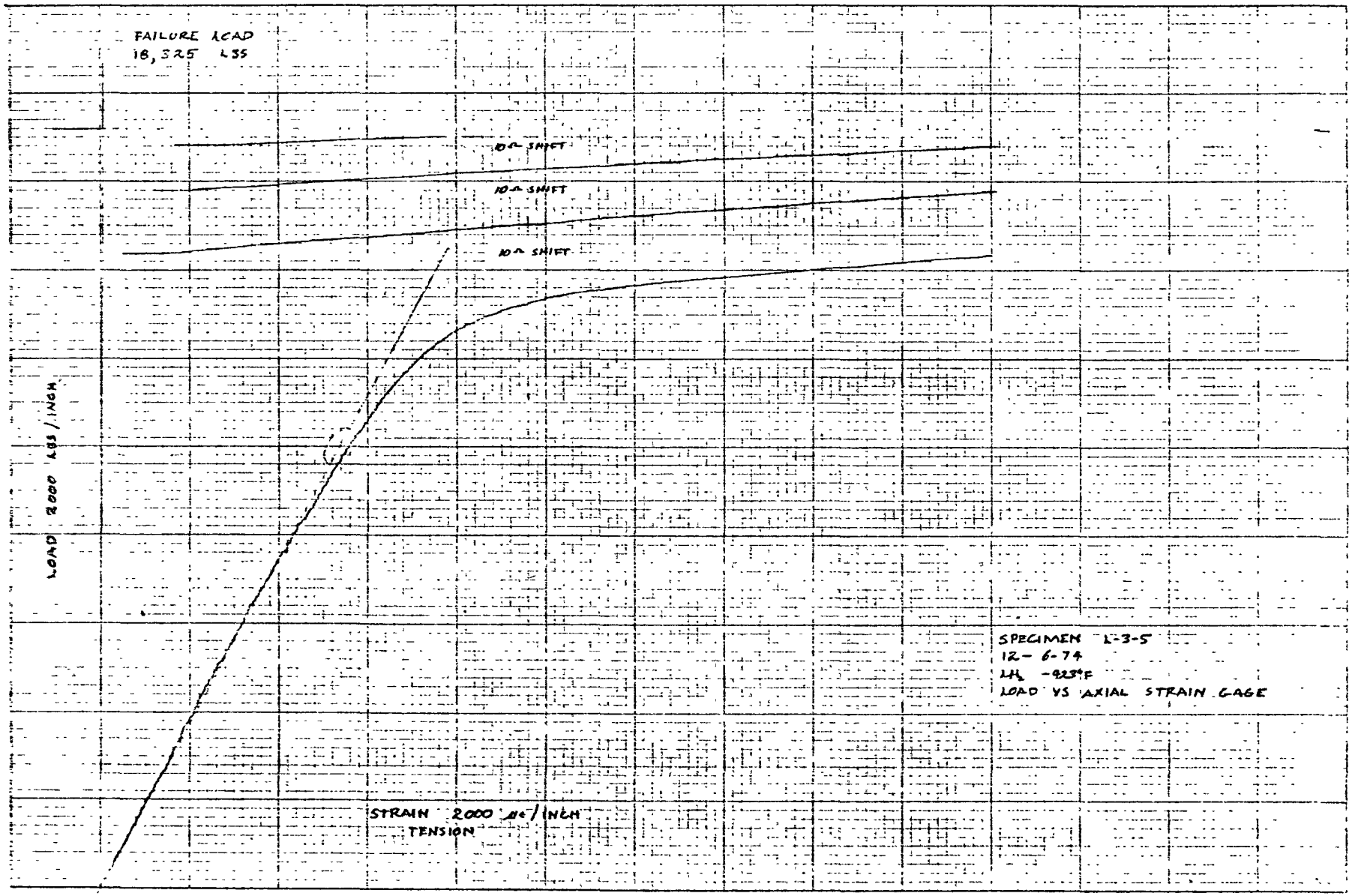
SPECIMEN T-3-5
12-4-74
LH2 -423
LOAD VS. POISSON STRAIN GAGE
FAILURE LOAD
18,900 LBS
STRAIN 2000 μ/INCH
COMPRESSION

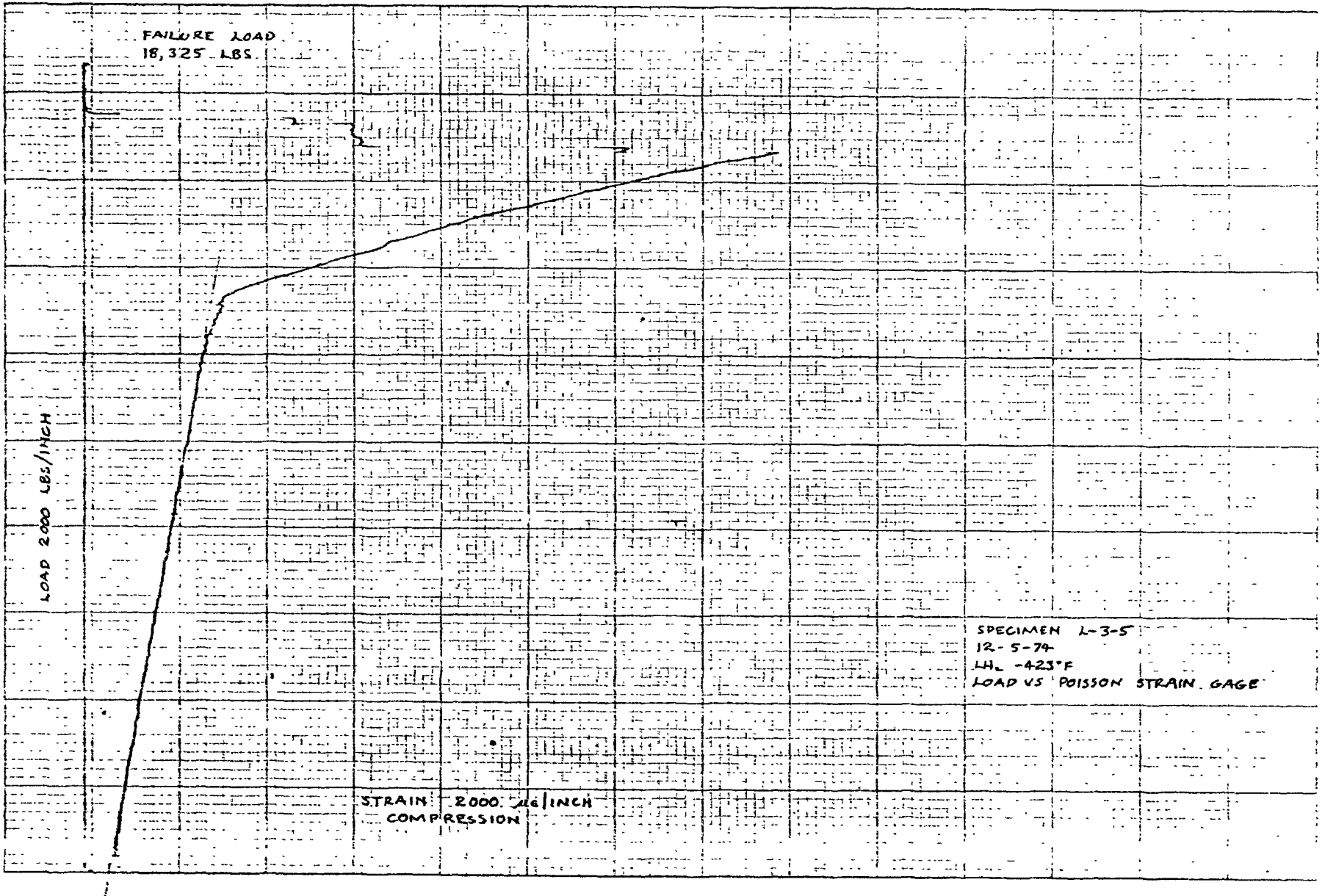

FAILURE LOAD
18,875 LBS
YIELD
13,300 LBS
LOAD 2000 LBS/INCH
SPECIMEN T-3-6
12-5-74
LH2 -423
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

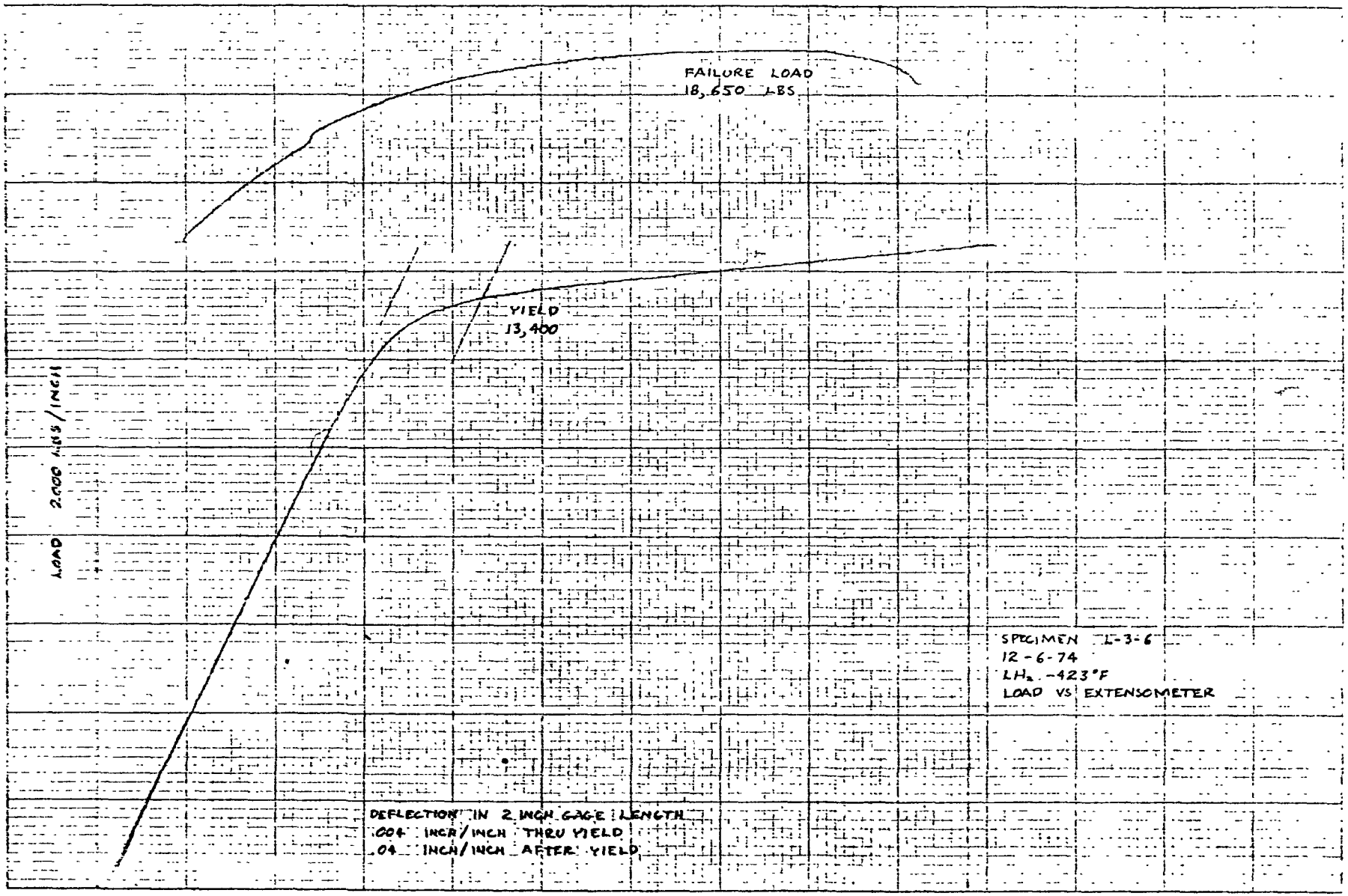
FAILURE LOAD
18,875 LBS
10^4 SHIFT
10^4 SHIFT
LOAD 1000 LBS/INCH
SPECIMEN T-3-6
12-5-74
LHL -423
LOAD VS AXIAL STRAIN GAGE
STRAIN 2000 μ/INCH
TENSION

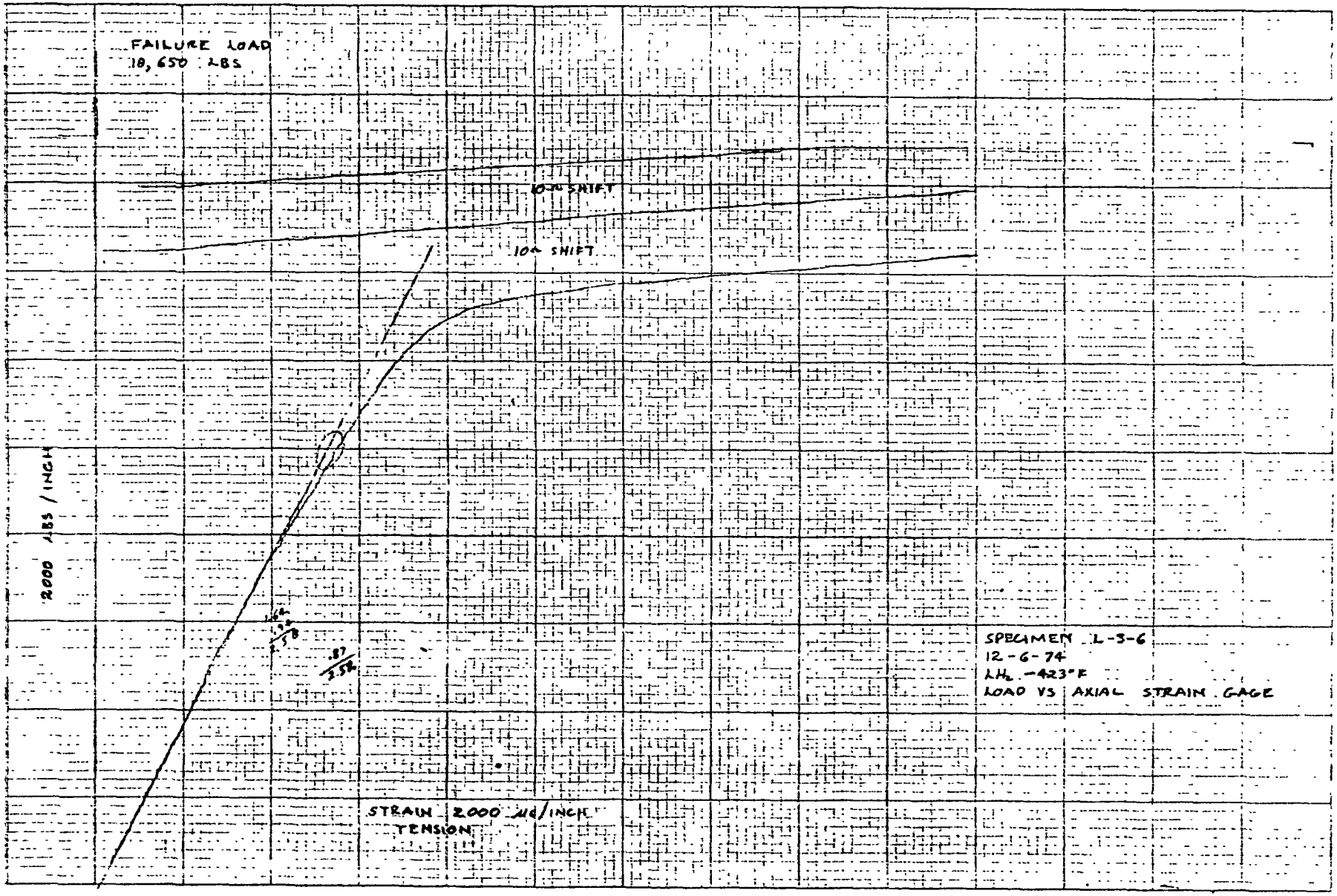
FAILURE LOAD
18,875 LBS
LOAD 2000 LBS/INCH
STRAIN 2000 μ/INCH
COMPRESSION
SPECIMEN T-3-6
12-5-74
JHL -423
LOAD VS POISSON STRAIN GAGE

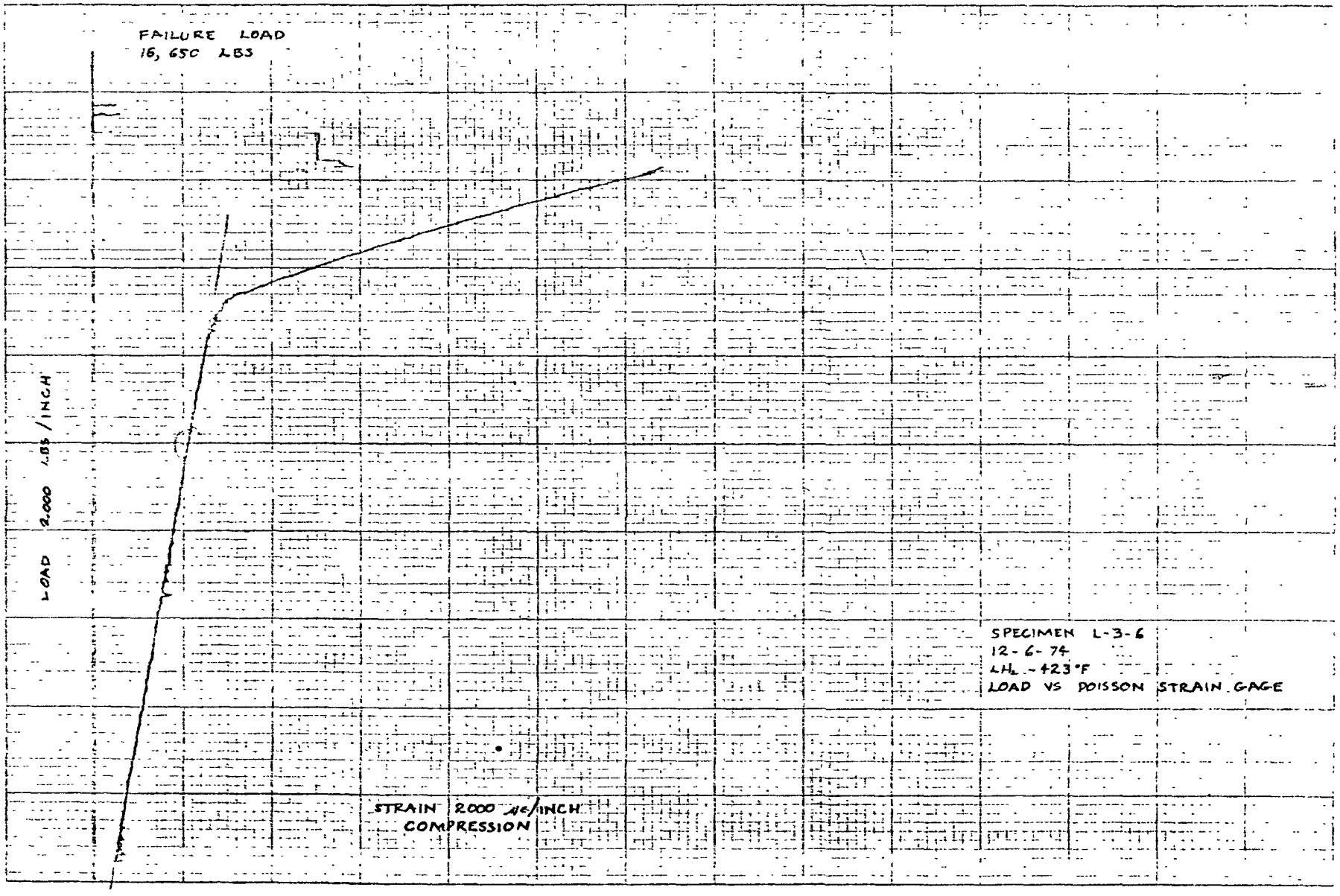
LOAD 2000 LBS/INCH
FAILURE LOAD
18,325 LBS
YIELD
13,050 LBS.
SPECIMEN L-3-5
12-5-74
24 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

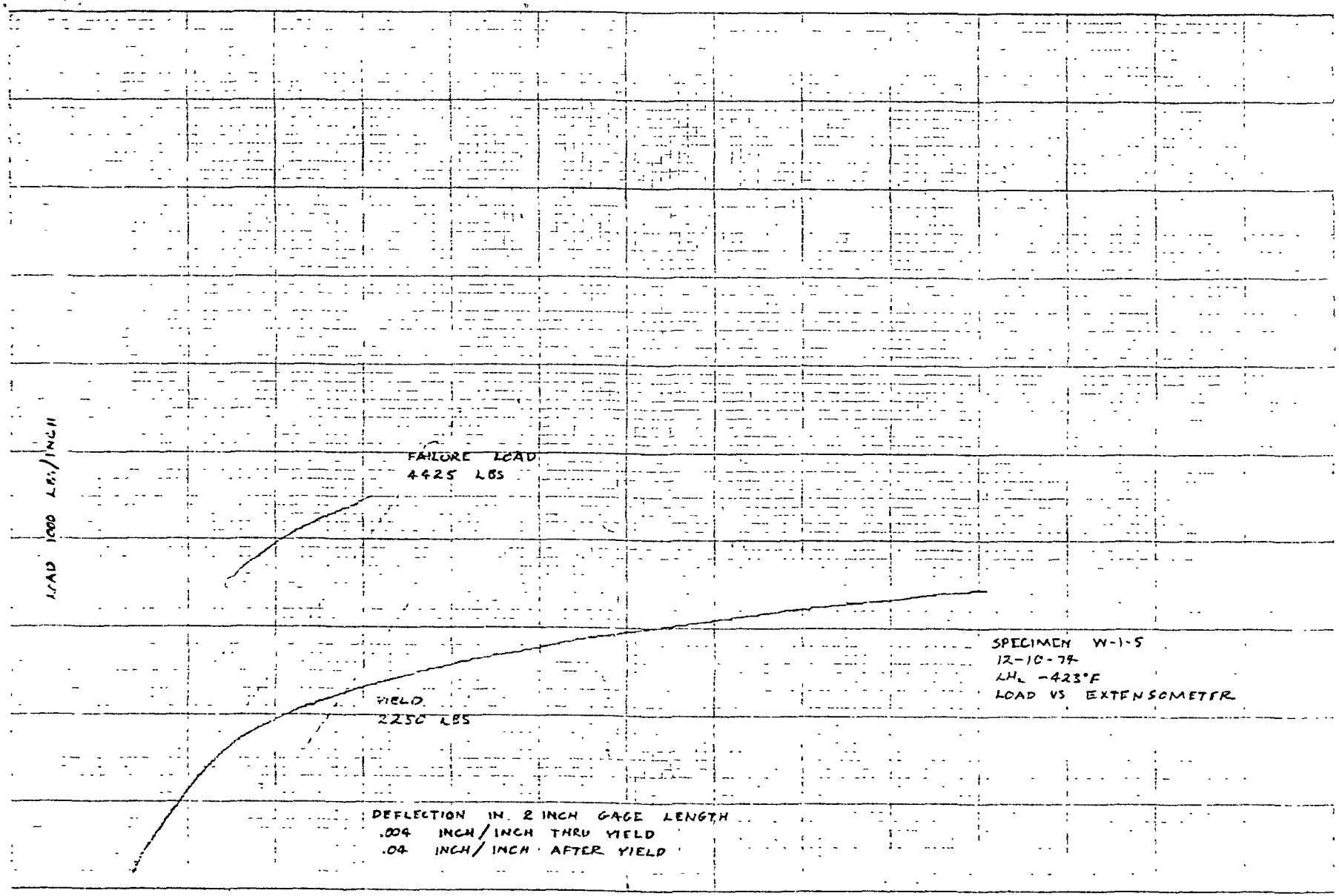

FAILURE LOAD
18,325 LBS
10^ SHIFT
10^ SHIFT
10^ SHIFT
LOAD 2000 LBS / INCH
STRAIN 2000 με / INCH
TENSION
SPECIMEN L-3-5
12-6-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE

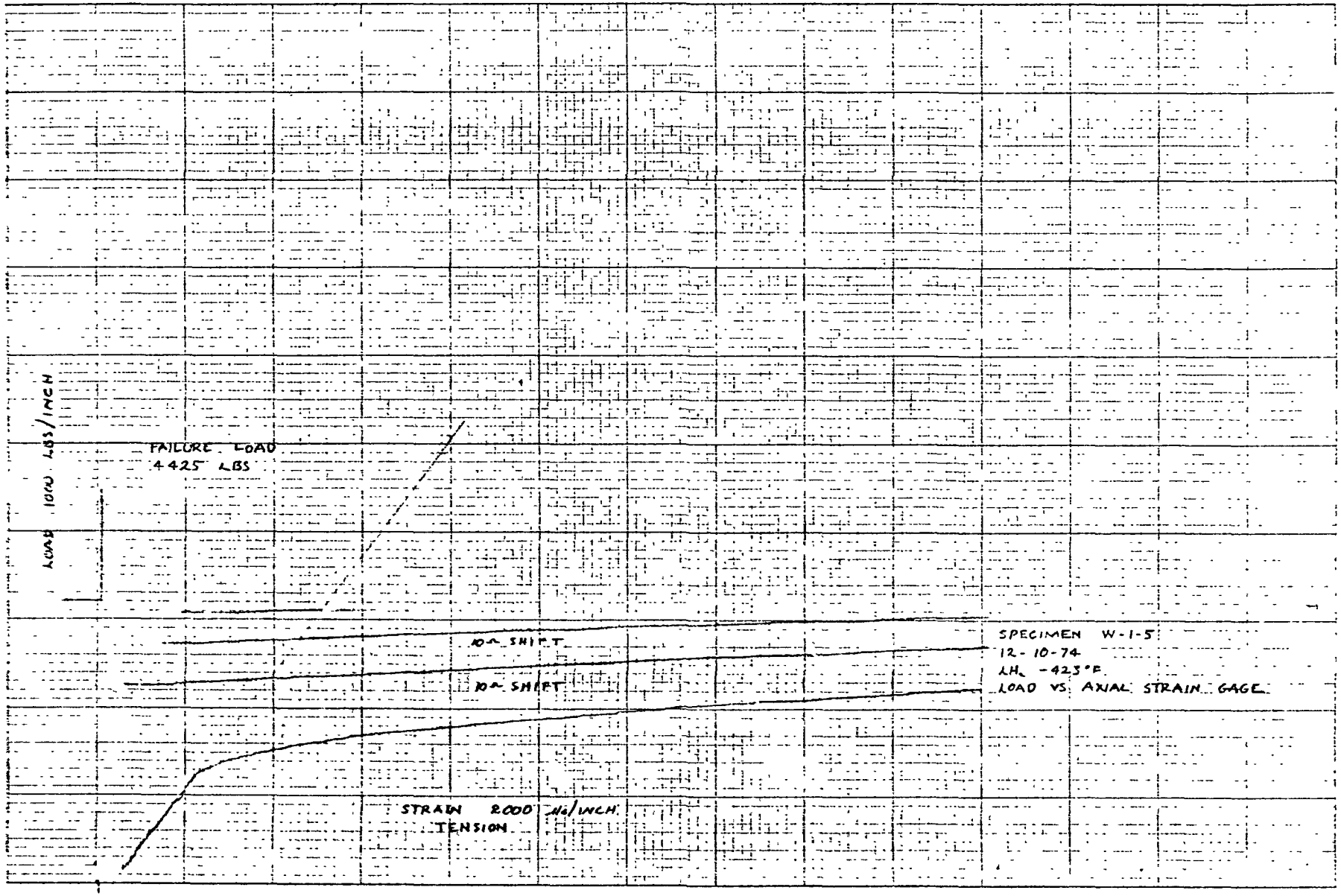

FAILURE LOAD
18,325 LBS.
LOAD 2000 LBS/INCH
STRAIN 2000 μ6/INCH
COMPRESSION
SPECIMEN L-3-5
12-5-74
LH2 -423°F
LOAD VS POISSON STRAIN GAGE


FAILURE LOAD
18,650 LBS
YIELD
13,400
LOAD 2,000 LBS/INCH
SPECIMEN L-3-6
12-6-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

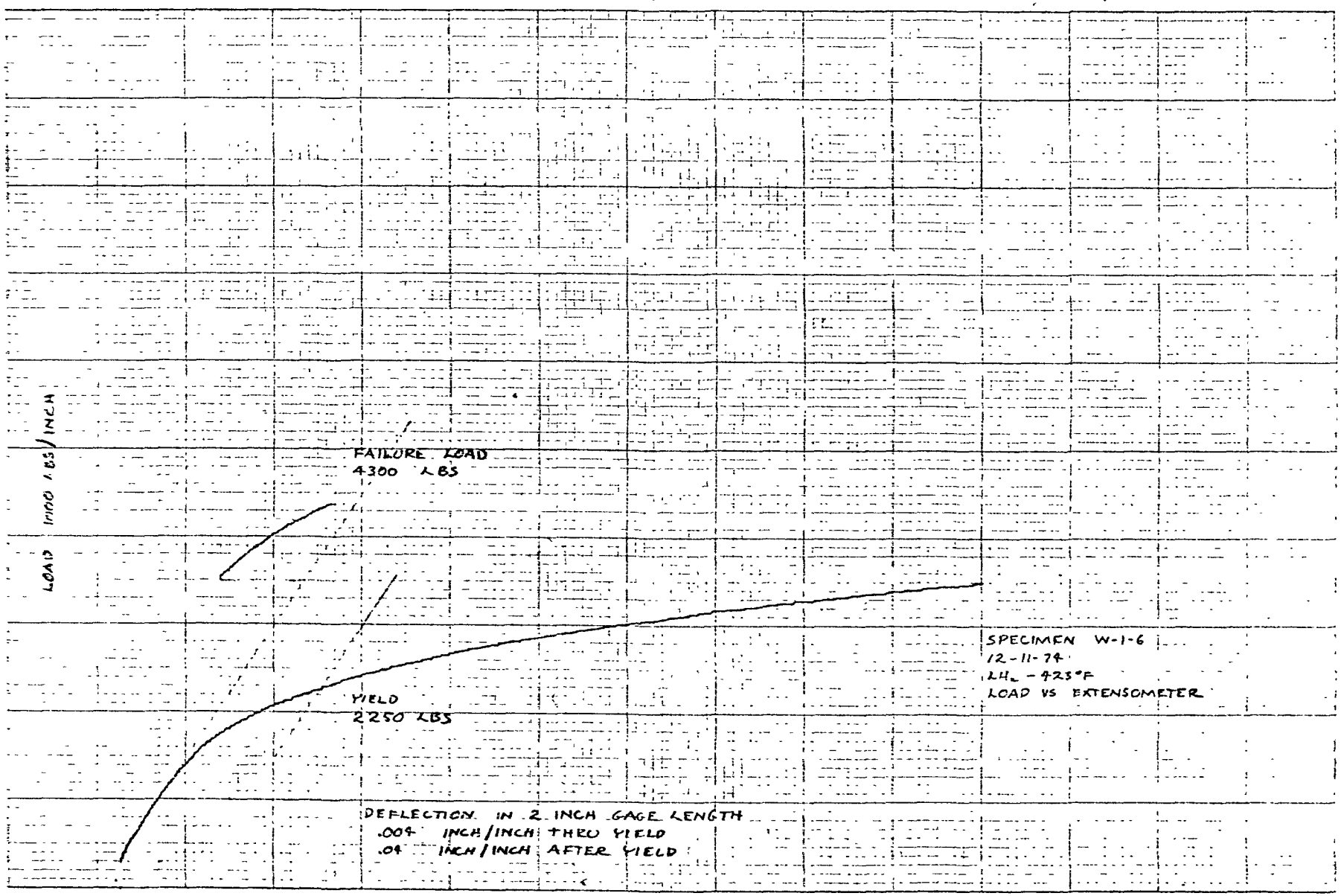

FAILURE LOAD
18,650 LBS
10^-6 SHIFT
10^-6 SHIFT
2000 LBS / INCH
STRAIN 2000 μ6/INCH
TENSION
SPECIMEN L-3-6
12-6-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE


FAILURE LOAD
16, 650 LBS
LOAD 2,000 LBS / INCH
STRAIN 2000 μ/INCH
COMPRESSION
SPECIMEN L-3-6
12-6-74
t_{H_e} -423°F
LOAD VS POISSON STRAIN GAGE


LOAD 1000 LBS/INCH
FAILURE LOAD
4425 LBS
YIELD
2250 LBS
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
SPECIMEN W-1-5
12-10-74
LH2 -423°F
LOAD VS EXTENSOMETER


LOAD 1000 LBS/INCH
FAILURE LOAD
4425 LBS
10^ SHIFT
10^ SHIFT
SPECIMEN W-1-5
12-10-74
LH2 -423°F
LOAD VS. AXIAL STRAIN GAGE
STRAIN 2000 μ/INCH
TENSION

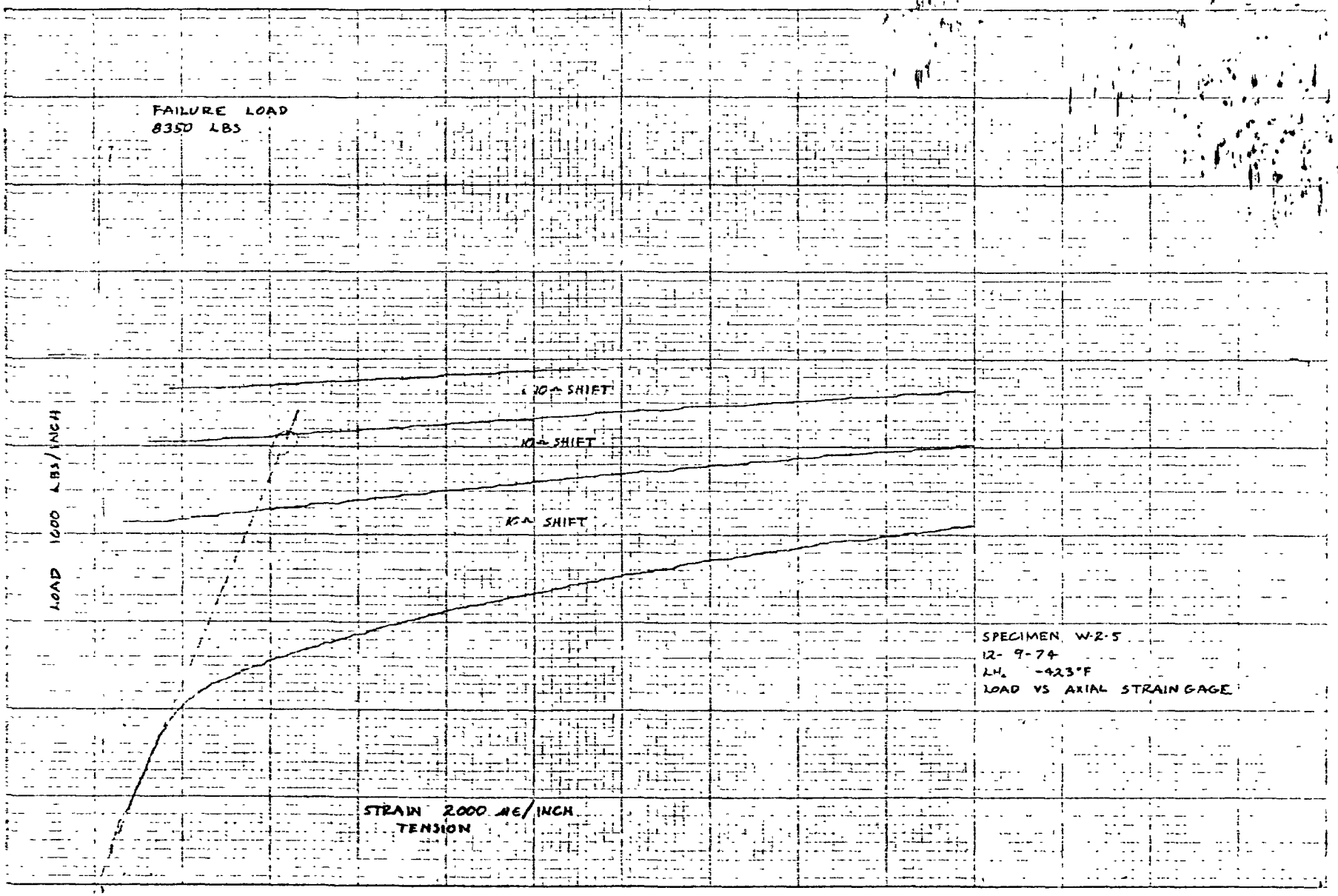
SPECIMEN W-1-5
12-10-74
LN2 -423°F
LOAD VS POISSON STRAIN GAGE
STRAIN 1000 μ in/inch
COMPRESSION
LOAD 1000 LBS/INCH
FAILURE LOAD
4425 LBS


LOAD (1000 LBS) / INCH
FAILURE LOAD
4300 LBS
YIELD
2250 LBS
SPECIMEN W-1-6
12-11-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD

SPECIMEN W-1-6
12-11-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE
RA SHIFT
RA SHIFT
STRAIN 2000 με/INCH
TENSION
LOAD 1000 LBS/INCH
FAILURE LOAD
4300 LBS

SPECIMEN W-1-6
12-11-74
LH2 -423°F
LOAD VS POISSON STRAIN GAGE
STRAIN 2000 μ/INCH
COMPRESSION
LOAD 1000 LBS/INCH
FAILURE LOAD
4300 LBS

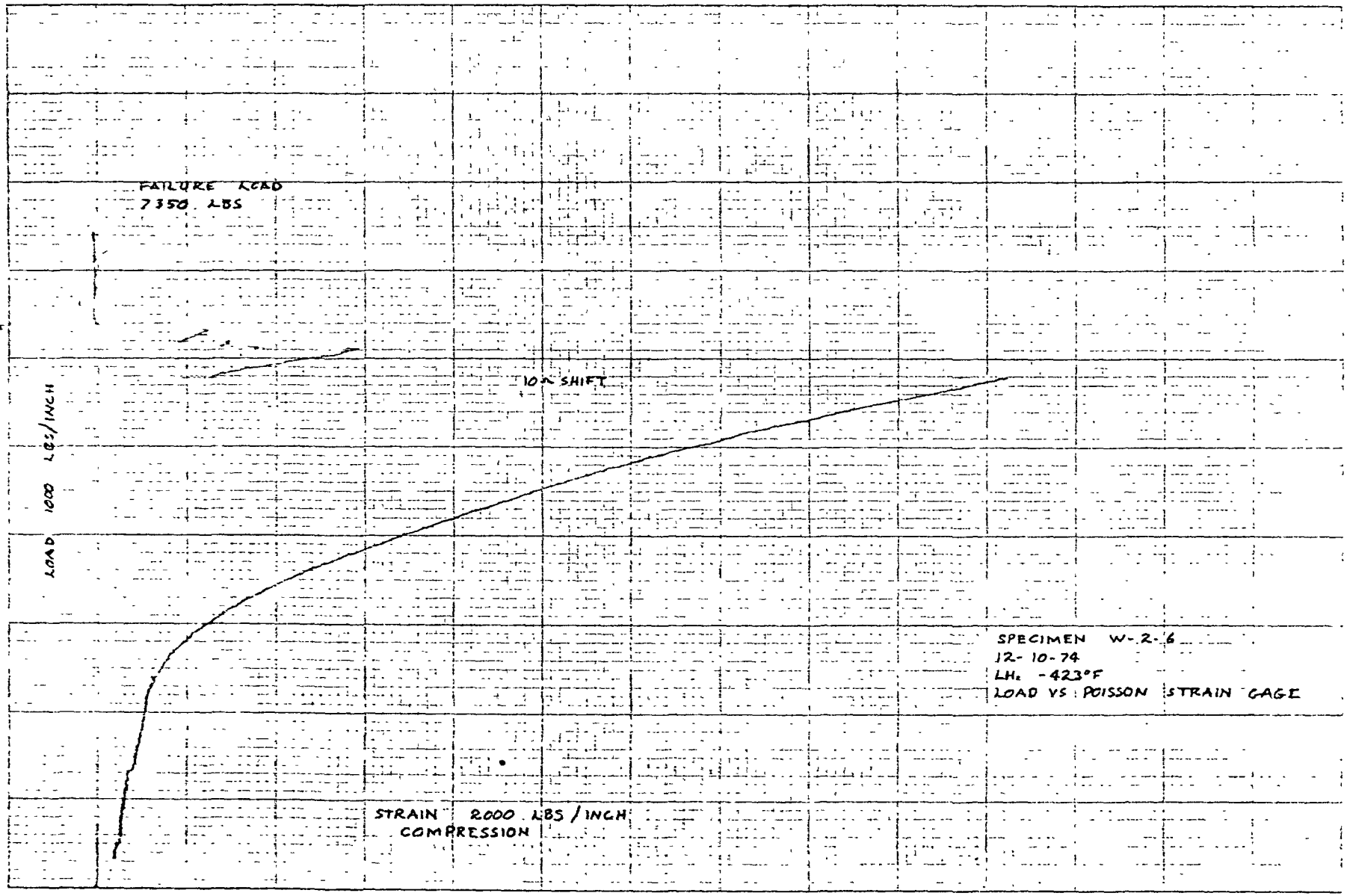
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12 - 9-74
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
YIELD 4100 LBS
FAILURE LOAD 8350 LBS
LOAD /000 LBS/INCH

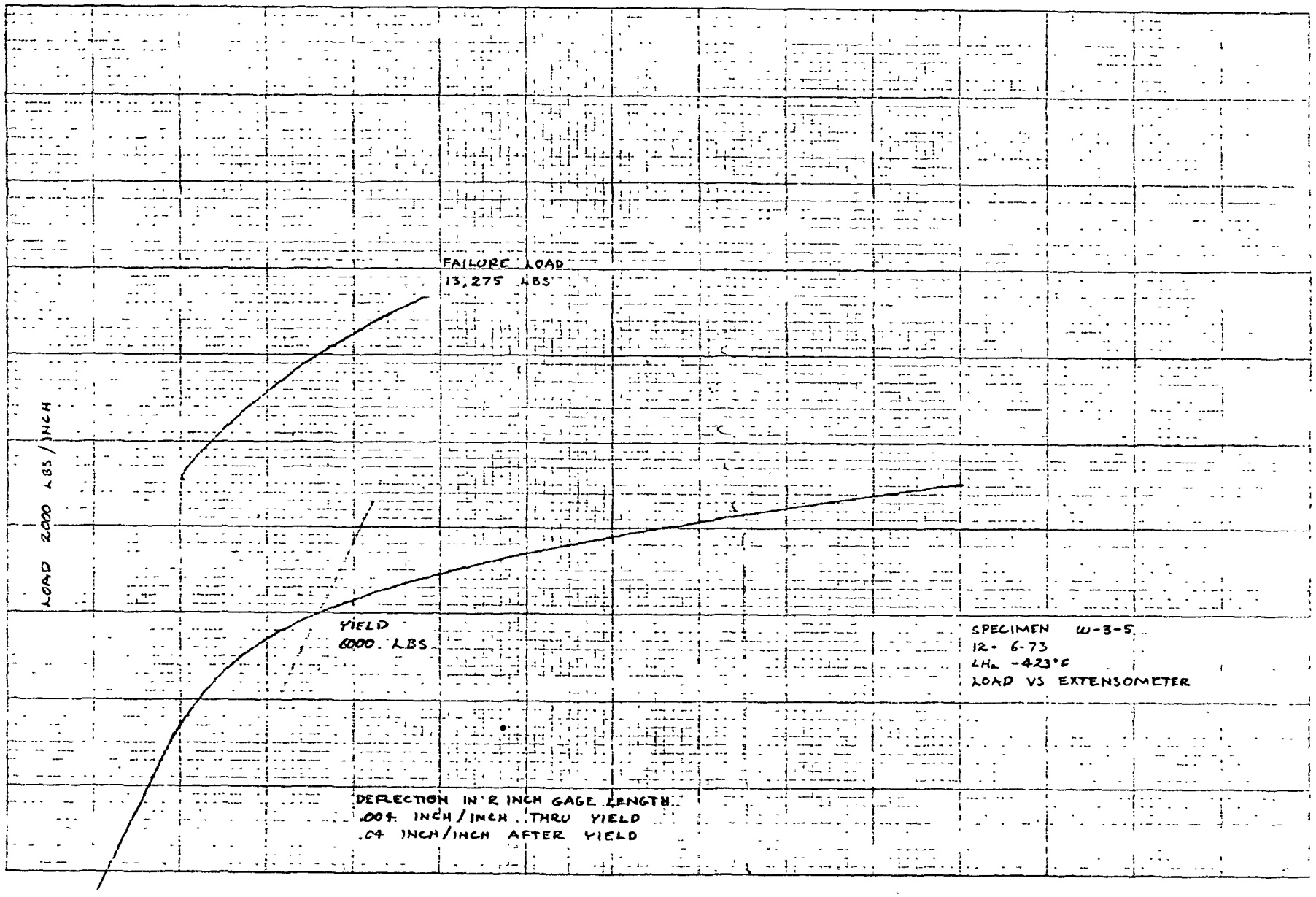

FAILURE LOAD
8350 LBS
20 SHIFT
10 SHIFT
10 SHIFT
LOAD 1000 LBS/INCH
STRAIN 2000 με/INCH
TENSION
SPECIMEN W-2-5
12- 9-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE

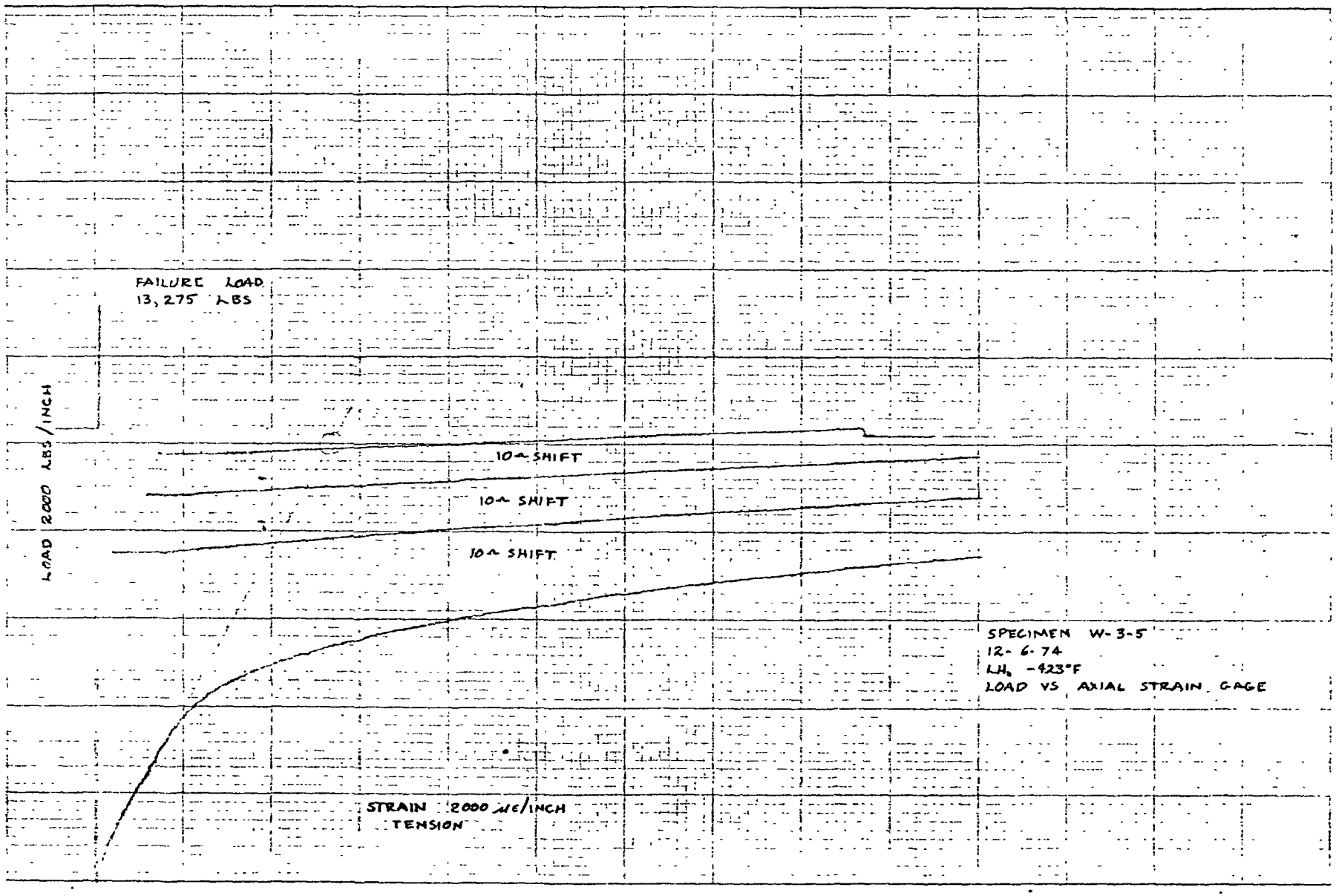
SPECIMEN W-2-5
12-9-74
LL -423°F
LOAD VS POISSON STRAIN GAGE
FAILURE LOAD
8350 LBS
LOAD 1000 LBS/INCH
STRAIN 2000 με/INCH
COMPRESSION

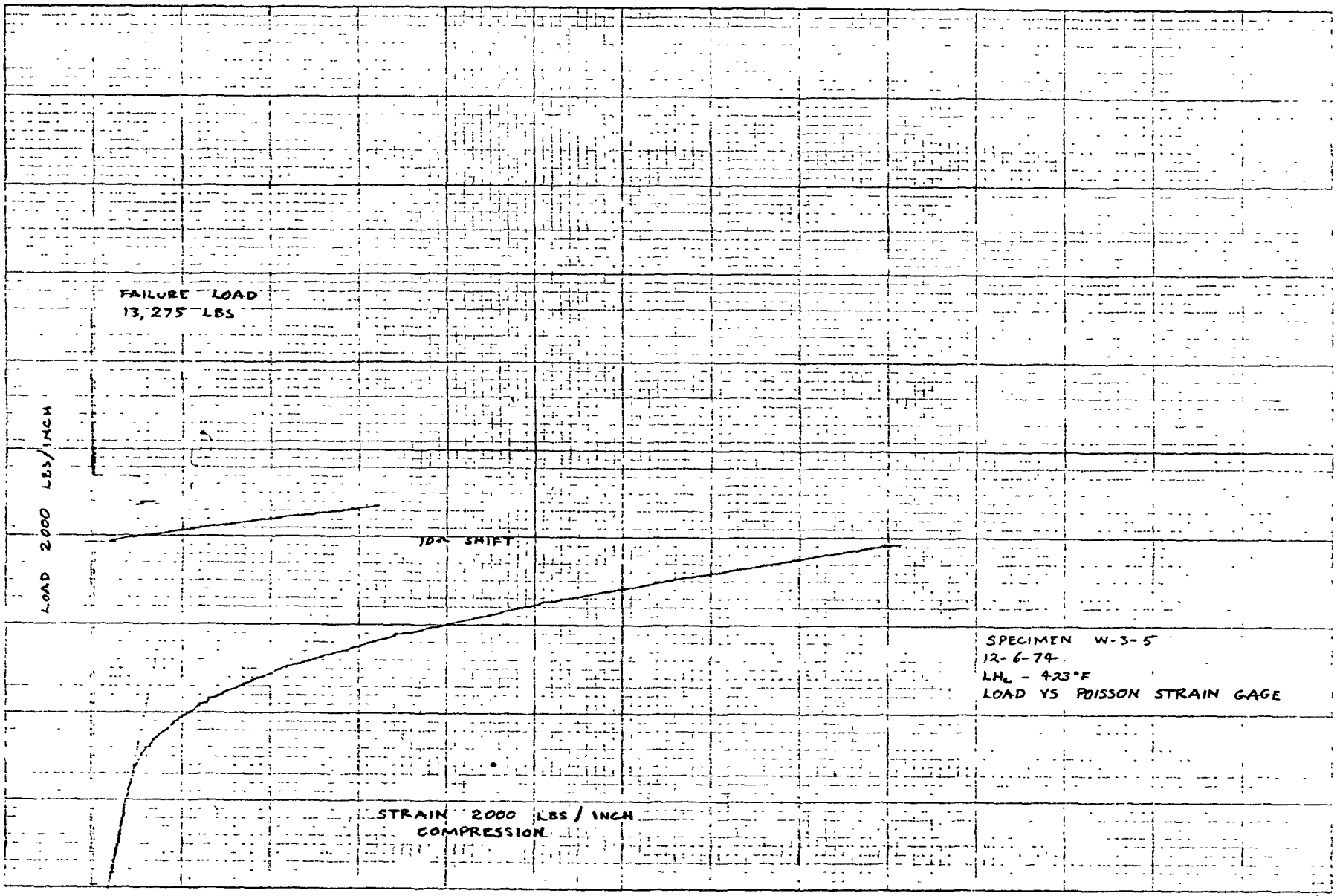
SPECIMEN W-2-6
12-10-74
LH₂ - 423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
YIELD
3950 LBS
FAILURE LOAD
7350 LBS
LOAD 1000 LBS/INCH

SPECIMEN W-R 6
12- 10- 74
LHL -423°F
LOAD VS AXIAL STRAIN GAGE
FAILURE LOAD
7350 LBS
LOAD 1000 LBS / INCH
STRAIN 2000 μ6/INCH
TENSION
10 SHIFT
10 SHIFT
10 SHIFT


FAILURE LOAD
7350 LBS
10% SHIFT
LOAD 1000 LBS/INCH
STRAIN 2000 LBS / INCH
COMPRESSION
SPECIMEN W-2-6
12-10-74
LH2 -423°F
LOAD VS POISSON STRAIN GAGE


FAILURE LOAD
13,275 LBS
LOAD 2000 LBS/INCH
YIELD
6000 LBS
SPECIMEN W-3-5
12-6-73
LH2 -423°F
LOAD VS EXTENSOMETER
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD


FAILURE LOAD
13,275 LBS
LOAD 2000 LBS/INCH
10^ SHIFT
10^ SHIFT
10^ SHIFT
SPECIMEN W-3-5
12-6-74
LH2 -423°F
LOAD VS AXIAL STRAIN GAGE
STRAIN 2000 μ/INCH
TENSION


FAILURE LOAD
13,275 LBS
LOAD 2000 LBS/INCH
10% SHIFT
SPECIMEN W-3-5
12-6-74
LH$_2$ - 423°F
LOAD VS POISSON STRAIN GAGE
STRAIN 2000 LBS / INCH
COMPRESSION

SPECIMEN W-3-6
12-9-74
LH2 -423°F
LOAD VS EXTENSOMETER
FAILURE LOAD
12,600 LBS
YIELD
5,850 LBS
DEFLECTION IN 2 INCH GAGE LENGTH
.004 INCH/INCH THRU YIELD
.04 INCH/INCH AFTER YIELD
LOAD 8,000 LBS/INCH

SPECIMEN W-3-6
12-9-74
RL - 423°F
LOAD VS AXIAL STRAIN GAGE
0% SHIFT
10% SHIFT
10% SHIFT
FAILURE LOAD
12,600 LBS
LOAD 2000 LBS/INCH
STRAIN 2000 μe/INCH
TENSION

SPECIMEN W-3-6
12-9-74
LH_2 -423°F
LOAD VS POISSON STRAIN GAGE
FAILURE LOAD
12,600 LBS
LOAD 2000 LBS/INCH
10% SHIFT
STRAIN 2000 μ/INCH
COMPRESSION

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